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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN, THE NATIONAL IRONFOUNDING EMPLOYERS' FEDERATION, THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.

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The B.C.I.R.A. Scottish Laboratories are:—
Foundry Technical Institute, Meek's Road, Falkirk (*Telephone* 332).

Forthcoming Events.

OCTOBER 30.

Institution of Mechanical Engineers (Graduates' Section):—Meeting in London. "Stainless Steels," Paper by F. H. Murdoch.

Institute of British Foundrymen.

OCTOBER 26.

Lancashire Branch (Junior Section):—President's address, followed by lecture, "The Manufacture of Iron Castings for Enamelling and Galvanising," by F. Griffiths.
East Midlands Branch:—Meeting at Derby. "Technical Control in the Small Foundry," Paper by J. G. Pearce.
Scottish Branch (Edinburgh Section):—"Grey-Iron Castings for Laundry Machinery," Paper by J. Longden.
Newcastle-upon-Tyne and District Branch:—Presidential address by J. D. Carmichael, O.B.E., followed by "The Building of the Sydney Harbour Bridge" (Film).

NOVEMBER 1.

London Branch:—Meeting at Charing Cross Hotel, London, at 8 p.m. "Cupola Practice," Paper by L. W. Bolton.
Lancashire Branch (Preston Section):—Meeting at Preston, at 7.30 p.m. "The Manufacture and Application of Centrifugal Castings," Paper by T. R. Twigger.

NOVEMBER 2.

Birmingham, Coventry and West Midlands Branch:—Meeting at Birmingham, at 7.30 p.m. "The Education of Foundry Workers," Paper by Prof. J. H. Andrew.

NOVEMBER 3.

Lancashire Branch (Burnley Section):—Meeting at Burnley, at 7.15 p.m. "Continuous Casting Plant," Paper by F. J. Cook (Past-President).

NOVEMBER 4.

Lancashire Branch:—Meeting at Manchester, at 4 p.m. "Continuous Casting Plant," Paper by F. J. Cook (Past-President).
Lancashire Branch (Junior Section):—Meeting at Manchester, at 7 p.m. "A Survey of Non-Ferrous Foundry Work," Paper by F. Dunleavy.

Works Visits.

Those engaged in the industry are frequently indebted to the courtesy and generosity of manufacturers who invite parties to view their works, and works visits have now become a well-established feature of the programme of many technical and scientific institutions. The average conference would, without them, be deprived of much of its value, and independent opportunities for such arrangements frequently arise.

The motive in some cases may be regarded as a desire to show an organisation which may have its spectacular side, and the maintenance of a policy with regard to such visits may be regarded as a legitimate part of advertising expenditure. Interesting as such visits are, they sometimes lack the interest aroused by a purely technical visit, because where works visits have to be organised to a point at which regular guides have to be detailed for the work they are seldom intimate with the finer points of technical and manufacturing importance. A visit of purely technical utility is best arranged with a very small party guided by someone who is familiar with technical detail. There is a certain amount of information given, and usually the discussion with respect to it involves the receipt of information in return, which, in its way, is very useful. Such visits benefit both those who give and those who receive.

Experience of a large number of works visits, particularly when big parties have to be accommodated, suggests to us certain definite rules which should be made use of if the comfort of the visitors is to be studied. To begin with, the guide should be able to speak the language of the group of persons to whom the works are being shown. Routes should be arranged which, as far as possible, prevent parties crossing each other's tracks. When this takes place it is inevitable that stragglers of one group tend to attach themselves to the other, and the original division becomes upset. Much assistance can be given in preventing this if the route is so arranged that the parties not only do not cross, but, as far as possible, take entirely different directions, and do not have to turn back. The route should, as far as possible, avoid bottlenecks and dead-ends, as the former delays progress and the latter frequently means that the stragglers in a given group do not reach the point of interest at all. A useful point which we noticed in visiting the Skoda works at Pilsen was the uniformed firemen who brought up the rear of each party and prevented stragglers attaching themselves to other groups, so that the original division on a language basis was maintained throughout. The whole organisation of this visit, in fact, was of the most praiseworthy character, although, of course, it could only be done in the case of a very large works and would only be necessary for an international party.

The First Steel Castings Report.

Although there are more than one hundred lectures and discussions down for hearing before the various branches of the Institute of British Foundrymen this winter session, no evenings will be more interesting than the two which Sheffield and Glasgow have reserved for an examination of the recently-published "First Steel Castings Report." It must be admitted that this Report has had a mixed reception by the steel-foundry industry, primarily because of the incidence of the word "First." In a "First" report, an industry expects to see, perhaps, something of the statistical position, possibly something of its prospects, but certainly it does expect a plain, unvarnished statement of its present technical position viewed from a number of aspects.

The Report which is to be discussed in Sheffield on November 7 would be excellent if it could have been published as a confidential document to the steel-foundry industry, but it quickly found its way into the hands of designers and buyers of castings, where undoubtedly it has given a wrong impression. If the Report had been the fifth, sixth or seventh, no great harm would have been done, but the fact that the "first" report has largely confined itself to the difficulties encountered in making a few extremely complex castings, which involved the production of a few wasters before perfection was reached, makes it an "out of balance" document.

The steel-foundry industry as a whole does not depend for its existence on puzzling its brains as to how to manufacture the weird and wonderful products of the drawing board for a few one-off jobs, but with how to make a profit on the

excellent lines of castings it makes for the railways, mines, marine and general engineers. Instead of this, Admiralty castings of the utmost variety were chosen for the "first" report, possibly because the investigational work was centred in the Woolwich Research Department. It would be interesting to learn from the discussions whether the general run of buyers are satisfied with the standard of the castings they are currently buying. We think that it would be of great interest if the various steel-foundry managers would disclose their loss from wasters, as we are aware that it is of very modest proportions from the average well-conducted steel foundry. This information is sought with the idea of informing the buyer that in general he has not to pay for an alarming percentage of wasters before he receives delivery of a wheel centre or tub wheel. The Report is undoubtedly an excellent one, except for the incidence of that all-important word "*first*."

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Mechanised Foundries.

To the Editor of The Foundry Trade Journal.

Sir,—In reference to your heading "Mechanisation and Effort," I don't know where you get these impressions from, but I think in fairness to me it should be contradicted. In my address at the James Watt Institute I said again and again that I was for mechanised plant every time. The point that I wished to emphasise was that where a plant was being installed it was often spoilt by the fact that it had not gone quite far enough, and stopped at the point where human labour was concerned. I also stated the fact that the plant I referred to in my address could have been made perfect if it had been carried that little bit further.

I also stated in the address that I had seen plants which were so good that they turned me green with envy. Do such remarks as these lead anyone to think that I was against progress or mechanisation? It may be you have been misled, hence the publication; otherwise I cannot understand your leader.—Yours, etc.,

Ernest John Lewis.

Domus, White Hill, Kinver,
Near Stourbridge.
October 22, 1933.

[We have re-read the remarks which Mr. Lewis has made about mechanised foundries, and he certainly has drawn a rather depressing picture of the conditions which he has seen, quite sufficient to warrant a more roseate sketch from a different angle.—Editor.]

Shipbuilders' General Meeting.—At the annual general meeting of the Central Board of the Shipbuilding Employers' Federation, held in Edinburgh on October 12, Mr. G. Tristram Edwards, assistant managing director of Messrs. Smith's Dock Company, Limited, of North Shields, Middlesbrough and Stockton, was elected President for the ensuing year, in succession to Mr. J. B. Hutchison, of Messrs. Scott's Shipbuilding & Engineering Company, Limited, Greenock. Mr. C. S. Swan, of Swan, Hunter & Wigham Richardson, Limited, Wallsend, and Mr. Maurice E. Denny, of William Denny & Brothers, Limited, Dumbarton, were re-elected Vice-Presidents. Mr. F. E. Rebbeck, of Harland & Wolff, Limited, Belfast, was also elected Vice-President to fill the vacancy caused by the election of Mr. Edwards to the presidency. Mr. H. Main, of the Caledon Shipbuilding & Engineering Company, Limited, Dundee, was appointed chairman of the Conference and Works Board of the Federation, with Mr. F. C. Mullens, of the Port Talbot Shipbuilding & Graving Dock Company, Limited, Port Talbot, as vice-chairman.

Notes from I.B.F. Branches.

Sheffield.—On Thursday, October 12, the members of the Sheffield Branch of the Institute paid a visit to the Stanton Iron Works Company, Limited, and spent an interesting time watching the various processes employed in manufacturing iron pipes, cast centrifugally in permanent moulds by the De Lavaud process. At the time of the visit the plant was producing between 50 to 60 miles of pipe per week. A striking experiment carried out in the test house was the testing to destruction of a long pipe loaded transversely, fracture occurring only after a considerable deflection had taken place. The visitors were also shown the plant devoted to cement manufacture, and the subsequent elaboration of this into articles of various types. In this department the visitors took a melancholy pleasure in admiring decorative and useful articles, such as lamp-posts, which were formerly made in cast iron, and are now apparently made quite successfully and at a lower cost in cement. The obvious retort of the foundry industry to this intrusion is to find some types of articles now made in cement which can be made either better or cheaper in cast iron.

For Tuesday, November 7, a meeting has been arranged which is of particular interest to steel foundry workers, and of general interest to all those concerned in foundry practice. At this meeting, the First Report of the Steel Castings Research Committee of the Iron and Steel Institute will be considered and discussed. The Report will be introduced by Dr. Moore, Chairman of the Research Committee, and by Dr. Greaves, and other members of the Research Committee will be present. Members who are not familiar with the Report are reminded that a very full abstract of it was printed in The Foundry Trade Journal issues of May 25, June 1, and June 8, 1933, and this should be perused before the meeting. In order to broaden the basis of the discussion, the members of the Sheffield Metallurgical Society will join the members of the Sheffield Branch of the Institute at this meeting, and the evening should prove both interesting and informative. This meeting will be held in the rooms of the Sheffield Metallurgical Society, West Street, and will begin at 7.30 p.m.

On Friday, November 17, a Paper will be given by Mr. E. S. Semper on "The Production of Oxygen and Dissolved Acetylene, and their Uses in the Foundry." On this occasion a film will be shown, illustrative of the use of oxygen and dissolved acetylene for welding and cutting, and another film demonstrating the use of dissolved oxygen as an explosive, in the mining of the raw materials for the manufacture of pig-iron. A number of slides will also be displayed, and arrangements have been made for experiments to be carried out at the meeting, illustrating the properties of liquid air. This meeting should prove entertaining as well as instructive, and will be held in the Grand Hotel, Sheffield, beginning at 7.45 p.m.

West Yorkshire Branch.—A change has been made in the printed programme, and instead of a works visit on November 11, Mr. H. A. McColl, B.Sc., lecturer on metallurgy at Bradford Technical College, will lecture upon the subject of "The Position of Technical Instruction in the Foundry." The venue is to be Bradford Technical College at 6.30.

Chromium Plating.—The theory of chromium plating is reviewed by E. Liebreich in the "Zeitschrift für Elektrochemie," while W. Melle in "Werkstoff Technik" describes tests with a special wear-testing machine, in which the sample is subjected to friction against emery, on the wear of non-alloy steels with 0.16 and 0.9 per cent. C., and of high-speed steels, containing 14 per cent. tungsten, with and without a chromium plating. The author also gives practical data of the effect of chromium plating on the life of measuring tools and drill bits.

Random Shots.

The visiting-cards controversy is not closed—at least so far as I am concerned. We must not be apathetic about this vital question; while others may sink back in their armchairs, content to go on using the same old visiting cards, I intend to burnish up my sword, harness the old war horse and sally forth into the fray, Mr. Eric N. Simons on my right hand. None can accuse me of sitting on the fence; I am coming out into the open to set up my standard. It shall never be said that "Marksman" was afraid to do or die for his faith. Take heed of my manifesto; I here and now wholeheartedly, absolutely and without a shadow of doubt pledge myself to those revolutionaries who have sworn to throw down and totally destroy the dull practice of using dignified and restrained visiting cards. Thrusting aside waverers and heretics who seem to use no visiting cards at all, let us ride onwards against the enemy!

* * *

The buyer picks up your pasteboard and looks at it—what a wonderful opportunity for a striking advertisement! Mr. Eric N. Simons suggests that on the back of the card should be printed a concise list of your products, and against the one which you think may particularly attract the buyer you pencil a neat cross. Very good, an excellent suggestion. It has only one fault, if I may say so, in that it does not go far enough. For instance, why should not representatives of foundries have their visiting cards cast in the foundry? A neat, workmanlike rectangle of cast iron, bearing the name of the representative and the address and telephone number of the foundry, would, as it were, speak for itself, and the buyer could not fail to be interested. I have seen the words "made in Sheffield" cast so sharply that the words seemed to have been stamped, so the idea could quite easily be put into practice. The only drawback would be weight, but if the representatives asked for their visiting cards back, they could use them again, and manage with half-a-dozen or so in a carpet bag.

* * *

Unfortunately we may stray into the realms of pure fancy if we apply the idea to other trades, although plastic cards would be feasible, and it would be easy for cotton salesmen to have their names woven into a piece of their best material. Confectionery travellers might carry long sticks of Brighton rock with their names in the middle instead of the ordinary "Present from Brighton," and when they called on a firm they would just break off a piece of rock and send it in to the buyer. But, to keep to the foundry trade, I suggest that a salesman might find it a good idea to trundle his latest marine casting round to a doubtful client's front door, hang on it a card bearing his name, and then ask the reception clerk to push it into the buyer's office. Unfortunately there might be a general strike on behalf of the reception clerk.

* * *

Another snappy idea would be to send in a signed photograph bearing such words as these: "Who is this? Do you not know? Why—it is Mr. Snooks, the charming representative of Messrs. Cooks & Books Bros., Limited! He wants to see you about . . ." If you have one of those real he-man faces, with pep and personality in every pore, the order will be as good as yours.

* * *

If you write to me at this address, mentioning the name of the paper in which you read this article, I will be delighted to supply you with limitless suggestions.

Marksman.

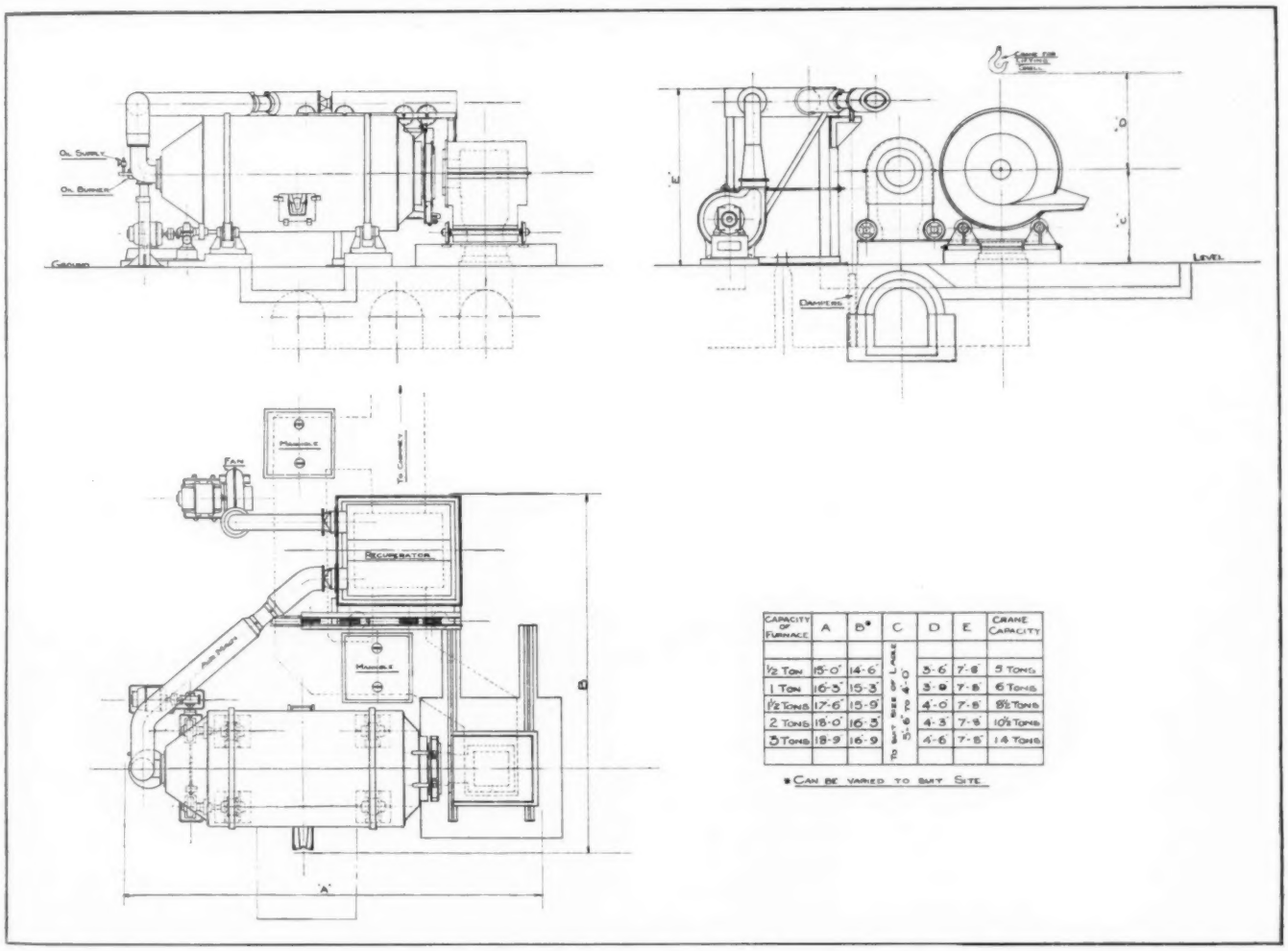
The Present Position of the Oil-Fired Rotary Furnace in England.*

By Vincent C. Faulkner.

At the time of writing there are installed in British iron foundries four rotary oil-fired furnaces of the Stein design—that is a type of furnace which is characterised by incorporating an electrically-driven rotating body using oil fuel combusted with hot air. It is well known that hand-rotated oil-fired furnaces are used in the non-ferrous foundry, whilst oil-tilting furnaces have been tried out in iron foundries. The author has personally inspected all these installations which are in operation in the works of Bayliss, Jones & Bayliss, Limited, of Wolverhampton; Bryan Donkin Company, Limited, Derby Road, Chesterfield; Castings, Limited, of Selborne Street, Walsall; and Harrison & Company (Lincoln), Limited, of Hykeham, near Lincoln.

The Stein furnace was first brought to the notice of the British public when last September it was shown at Paris in operation at the exhibition held in conjunction with an International Foundry Conference. Later that year, Mr. T. E. Unwin read a Paper on the use of fuel oil in which he reviewed comprehensively the furnaces available for use by British foundries. He included a description of the Stein furnace, but such progress has been realised since that time that a fresh description now appears essential. The general principles are shown in Fig. 1, from which it will be seen that a mild-steel cylindrical casing, coned at the burner end is mounted on two pairs of rollers. The rotary motion is communicated to the casing by means of a friction drive through one pair of the rollers. These are actuated by an electric motor through a Brown reduction gear. Push-button control is provided for communicating either continuous or oscillatory motion to the furnace body. At the end remote from the oil burner, the products of combustion enter a removable firebrick-lined box, which, when in position, communicates with an underground flue leading to a recuperator. The recuperator is of the type which causes the hot gases to pass around a number of steel tubes interconnected with malleable cast-iron bends. An electrically-driven fan blows air through the heated tubes for combustion with the oil. On the switchboard, pyrometers are mounted, which enable the operator to keep a check on the temperature of the combustion. The finishing temperature of the combustion air is controlled at definite figures varying between 300 and 400 deg. C. in different installations, and furnishes a definite indication of the temperature within the furnace. It is easy to lower the temperature of the air by opening up the chimney damper and so decreasing the input of heat to the recuperator tubes. The furnace is lined with the various types of plastic refractory materials now on the market, and reasonably good results are being obtained. Co-operation between the users of all classes of rotary melting furnaces and the refractory materials manufacturers would be useful to all parties in increasing life. The lining is not as thick as is usual in the pulverised-fuel-fired furnace. For charging, the box-like connection with the waste-gas flue is removed, and the hole covered with a steel plate. For emptying, a centrally-disposed tap hole is opened up as in cupola practice, but botting-in is, of course, eliminated owing to the ability smoothly and gently to rotate the furnace. The slag-hole is capable of being opened out to about 3 in. dia., which allows of a proper draining of the furnace. Personal inspection has convinced us that a large diameter slag-hole is of real importance in obtaining a really clean furnace. This in its turn has its influence on the metallurgical control of composition.

The oil is pumped either by an electrically- or manually-operated pump to a conveniently-situated oil-storage tank, from which the burner is fed by gravity. The burner, which was well described by Mr. Unwin, still holds good, but in some cases an electrical gadget has been added in the form of a short length of resistance wire, installed in the oil pipe for use in warming up the oil on very cold mornings. The circuit for this takes in an electric bulb to make operators aware that it is functioning. As in every high-temperature metallurgical process with which we are



Capacity of Furnace	A	B*	C	D	E	Crane Capacity
½ Ton	15'-0"	14'-6"	3'-6" to Base of Lugs 4'-0"	5'-6"	7'-8"	5 Tons
1 Ton	16'-5"	15'-3"		5'-9"	7'-8"	6 Tons
1½ Tons	17'-6"	15'-9"		4'-0"	7'-8"	8½ Tons
2 Tons	18'-0"	16'-3"		4'-3"	7'-8"	10½ Tons
3 Tons	18'-9"	16'-9"		4'-6"	7'-8"	14 Tons

*Can be varied to suit site

Fig. 1.—General Lay-out of the Stein Oil-Fired Rotary Furnace.

* Foundry Trade Journal, November 17, 1932, page 295, *et seq.*

familiar, much information is to be gained from the appearance of any flame leaving the furnace, and at the Bayliss installation a mirror, made from stainless steel, has been erected in such a position that the man adjusting the burner has an excellent view of the flame at the exit end of the furnace.

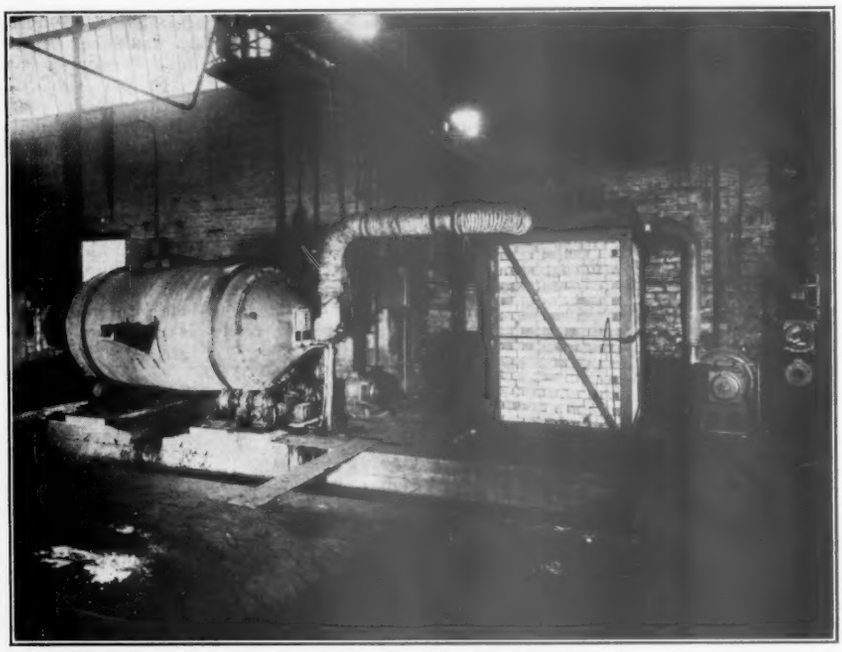


Fig. 2.—The Stein Furnace of 30-cwt. Capacity Installation at Messrs. Bayliss, Jones & Bayliss.

For inspecting the furnaces, the works were visited in the following order:—Chesterfield, Wolverhampton, Walsall and Lincoln, and perhaps the best way of evaluating the merits of the Stein furnace is to register personal impressions of each plant.

The Bryan Donkin Plant.

At this works the plant, which is of 10 cwts. capacity, is only used intermittently for the manufacture of high-pressure resisting castings used in connection with the gas industry. It is installed in a bay running alongside the main foundry, and has been erected at right angles to the outside wall; this lay-out permits of the easy transport of the liquid metal to the foundry. This is effected by a short length of light railway, on which runs a bogie car carrying a ladle suitable for crane handling in both main and side bays. At the time of our visit about 60 heats had been made. The first lining—a rammed plastic refractory—lasted 25 heats, but the second one had every appearance of lasting very much longer. The metal was, undoubtedly, superheated, and was obviously giving complete satisfaction in stringent tests imposed upon the castings made from it, the standard test being to subject the castings to air pressure under water. The oil consumption was on the high side, about 50 galls. per ton, as compared with the other plants inspected, due, no doubt, to the intermittent character of its operation. This, too, militates against the obtaining of the best figures for the life of lining. The furnace was reported to have been almost entirely free from mechanical breakdown. A spare body is carried for melting non-ferrous metals.

Bayliss, Jones & Bayliss.

At the time of our visit the body of the furnace was being re-lined and we welcomed the opportunity of examining the technique. Normally, of course, the plant would not be shut down because of this, as it is customary to furnish a spare body, which is kept in readiness —lined and dried-out by slow-firing. The furnace is of 30-cwts. capacity and it is used for the preparation of metal for rolls, alloyed cast iron and high-duty material. Its running has been somewhat of an intermittent character, but when two casts are made consecutively the oil consumption is of the order of 45 galls. per ton; if four casts be made consecutively the consumption falls to 36 galls. per ton. It was ascertained that the metallic losses were constant at 0.4 per cent. silicon and 0.3 per cent. carbon. The manganese loss was apparently negligible. Good hot metal, to use a foundry term, was reported to be easily attainable, but the standardisation of chill depth constituted a problem which was nearing solution. Advantage had been taken of the shut down to examine the pipes and brickwork of the recuperators, which after 78 heats were reported to be in splendid condition. Progress is being made with the construction of linings and a minimum of 100 heats can be confidently expected in the future. The management were obviously well satisfied with the performances and potentialities of the plant.

Castings, Limited.

This plant, of 30-cwts. capacity, is continuously engaged on the manufacture of small and medium malleable and grey-iron castings. It has been so successful that the cupola is no longer used. Whilst it may be beside the question of Stein furnaces, this comparatively small works is amongst the tidiest and most orderly we have ever encountered, whilst the management is particularly intelligent. The test of material made is eminently satisfactory and has enabled the annealing cycle to be shortened, as lower C and higher Si material having the necessary fluidity can be consistently produced. The lay-out of this plant is excellent, and the first lining gave 98 heats. The furnace is situated at the end of the shop, which has allowed the recuperator to be built outside, together with its own chimney. Scrap can be stored and charged into the furnace with a minimum of handling. The only snag encountered since the installation of the furnace was a leakage in the recuperator pipes in the early trials. After this was remedied substantial progress was made. Whilst it is not of outstanding commercial importance, it has been found quite difficult to introduce carbon into the bath. This is a phase of metallurgy common to all processes, as those who have attempted to make synthetic cast iron from a steel base will know. The difficult range we have found to be from 2 to 3 per cent. carbon.

We are informed that experiments in France using ground retort carbon have been reasonably successful.

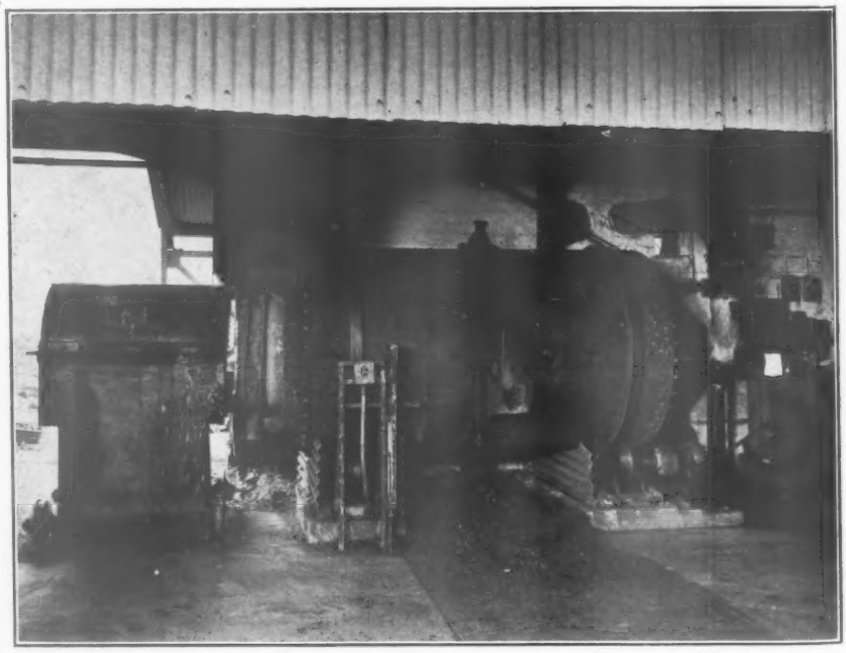


Fig. 3.—30-cwt. Stein Oil-Fired Furnace installed in the Works of Messrs. Castings, Limited, Walsall.

Harrison & Company (Lincoln), Limited.

In this foundry there is the largest Stein furnace in England; it has a capacity of 2 tons, and is regularly engaged on the production of

high-grade malleable-iron castings for the automobile and kindred industries. The general features of the furnace are much the same as exist elsewhere, but here the technical performance of the furnace is ahead of the other in-

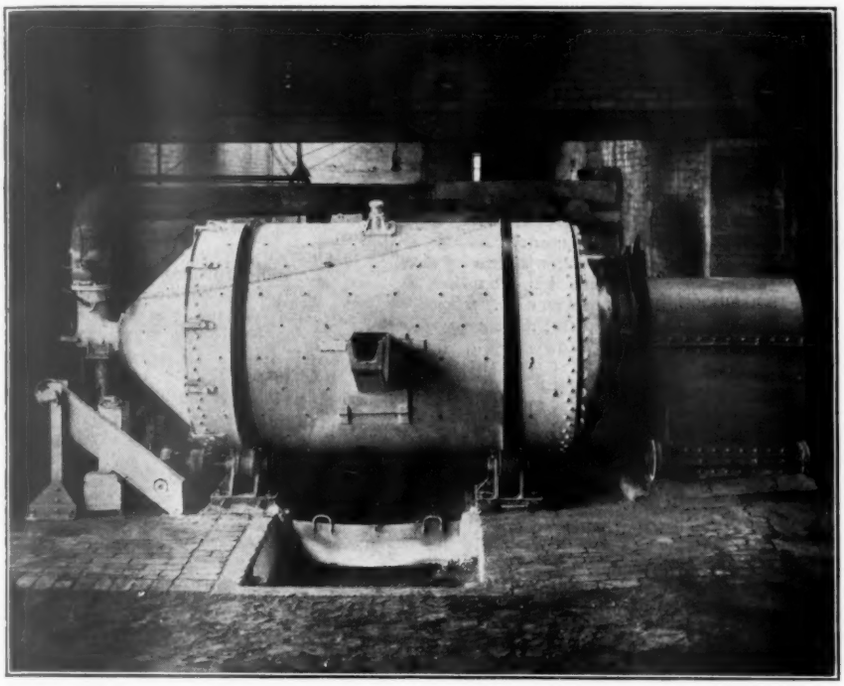


Fig. 4.—Stein Furnace installed for melting Malleable at the Works of Messrs. Harrison & Company, Limited, Lincoln.

stallations, as it is worked regularly day after day and possesses a greater capacity. We noted here, as we have encountered in other malleable foundries, the considerable time taken to empty the furnace. Certainly the heat is well maintained, and in any case the flame can still be kept running. We think these conditions are due to the fact that for many years a continuous melting process was used, and the metal could advantageously be handled in driblets. We do not suggest that a 2-ton ladle should be filled and then act as a reservoir, but we are of opinion that there would be less heat lost through using fair-sized bull ladles, taking these to a convenient centre for distribution by hand shanks. This criticism is not levelled at the Harrison management, but is one which applies to the malleable industry in general. After all, a bottom-pouring steel ladle of 2 tons capacity is often opened well over 100 times during a cast. The metallurgical control is excellent, and the conduct of the furnace has been so standardised that standard compositions can be reproduced day after day to a nicety. The metallic losses were of the same order as at Bayliss, Jones & Bayliss, but somewhat higher.

When first installed, the furnace suffered a little from teething troubles, purely of a mechanical type, but its metallurgical potentialities were appreciated immediately, and the management is now completely satisfied with its performance. The fuel consumption is about 35 galls. per ton.

General Inferences.

The Stein furnace, which is made in its entirety in England, is handled in the British Empire and Scandinavia by Messrs. Stein & Atkinson, of 47, Victoria Street, London, S.W.1. It has found its first application in the British foundry industry amongst firms making either malleable or high-grade grey-iron castings in relatively small quantities. Whether the capacity range can be usefully extended up or down is a matter of interesting speculation. From the metallurgical and engineering points of view, larger furnaces present no difficulty. In fact, the larger the furnace the easier the metallurgical control, but fuel costs assume added importance. A downward scaling would mean an out-of-balance installation cost compared with output. For the capacities so far standardised, capital expenditure is kept within reason as, apart from the furnace proper, there is but the oil tank, recuperator, and in a few cases only a short length of chimney to build. The cost of handling oil fuel is, of course, extremely low, whilst with modern burners the cleanliness of operation is assured. The lining of the body is much thinner than is standard in pulverised-fuel

Fig. 5.—Charging a 30-cwt. Stein Oil-Fired Rotary Melting Furnace.

furnaces and there is every reason to believe that the refractory costs will be considerably reduced, as a minimum of 100 heats was confidently expected by each of the four users. We confess to some pre-conceived notions as to excessive metallic losses. Losses are experienced, but are definitely controllable, and by wise choice of raw materials involve no extra cost. We have been left with the impression that the larger the capacity the easier the metallurgical control, and if we were installing this type of furnace we should choose as large a size as production would allow of. We think that average depth of bath and ease of metallurgical control are inter-related and need careful co-relation. It can be stated that the relationships existing between the designers and the foundries we visited are so good that with the passage of time data should be available to prove this point. As the furnace linings wear, the bath becomes progressively shallowed, and its influence on metallic losses should be established as being either negligible or progressively greater or less.

Considering the relative newness of the Stein furnace, it can be definitely stated that it has already achieved for itself an established position within the grey- and malleable-iron foundry industries. There are now 28 Stein furnaces of this type in operation throughout the world and three fresh installations are being erected in the British Empire—one at Dronfield, another at Enfield and a third one in Australia.

Acknowledgments.

We wish very sincerely and cordially to acknowledge the many kindnesses and courtesies extended to us during the process of accumulating the data and impressions set out above to Mr. W. D. Bullows (Castings, Limited); Mr. Percy Bayliss (Messrs. Bayliss, Jones & Bayliss); Mr. G. Clark (The Bryan Donkin Company); Mr. G. T. Wildsmith (Harrison & Company); Mr. C. H. Williams (Stein & Atkinson), and to their technical staffs.

Supplementary Note by Mr. C. A. Williams.

We visited Messrs. Castings, Limited, the other day, and they informed us that the second lining of their furnace was still in service after 108 heats and that they expected to get a further 20 heats out of it. They have also been conducting some tests, not exactly on recarburisation but on the prevention of any carbon loss, and this has been most successful. We are informed that they can *regularly* cast with about 0.1 per cent. total carbon more than they charge.

Falkirk Foundry Trade.—The Ironfounding Workers' Association, representing the men in the light-castings industry in Scotland and England, has achieved a remarkable recovery. The number of unemployed has been reduced from 1,500 in March to 466 this week. The total membership is 8,510, so that unemployment has been reduced to manageable proportions. Much of the improvement is due to the large orders for baths and other household materials obtained by the foundries in the Falkirk area. One of the officials stated that the union has now the lowest percentage of unemployment since 1928.

Mr. Hugh Murdoch, general secretary of the Iron Founding Workers' Association, states: There has been a decrease of 705 in the union list of unemployed since March, whilst 1,415 who were on short time are now working full hours. He thinks that the present improvement is likely to continue for some time to come. Traders in the Falkirk area are busier than they have been for a long period, proving that increased buying power among the workers is the best tonic for business and commerce.

The five years' slump between 1928 and 1933 practically wiped out the reserves of the Association. Fully £56,000 was spent in unemployment benefit, and the members had to adopt a scheme of financial reorganisation to prevent insolvency. The financial position has now greatly improved, and the reserve funds are being increased at the rate of £1,500 a quarter. If the trade balance is maintained in favour of the Association, the cash resources will be comparatively strong within the year.

The International Foundry Conference in Czecho-Slovakia.

By T. Makemson.

(*Concluded from page 220.*)

Skoda Works.

The Skoda Works was founded in 1869. It grew to large dimensions, and until the end of the war was one of the principal sources of supply of armaments to the Austrian Empire. It is now perhaps the most impressive engineering works in Czecho-Slovakia, and one of the great engineering factories of the Continent. After the conclusion of the war it was necessary to find different kinds of employment for this huge factory and its equipment, and considerable alterations in the structure of the company took place. Other industrial undertakings were absorbed, and in 1929 the company had nearly 40,000 employees.

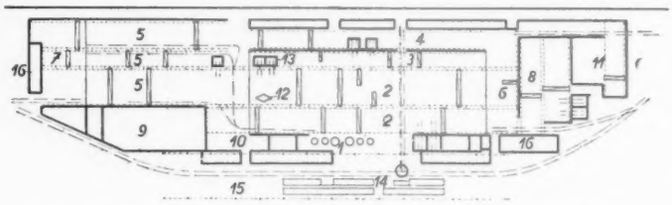


Fig. 7.—Plant of the Grey-Iron Foundry of Skoda at Pilsen.

1—Cupolas. 2—Moulding floor for large castings. 3—Moulding floor for medium castings. 4—Moulding floor for small castings. 5—Mass production section. 6—Fettling shop for jobbing castings. 7—Fettling shop for quantity-production castings. 8—Apprentices' Department. 9—Core-making shop. 10—Sand conditioning plant. 11—Stores for patterns in use. 12—Electric steel furnace. 13—Drying ovens. 14—Pig-iron stores. 15—Moulding-box stores.

The manufactures of this huge organisation are divided into five main divisions, as follow:—

(*A*) *Metallurgical Products.*—(1) Iron castings, steel castings and forgings; (2) Skoda manganese steel; (3) rolled and drawn bar and section steel; (4) special products; and (5) aluminium, bronze and white metal.

(*B*) *General Engineering.*—(1) Prime movers: (*a*) Steam engines; (*b*) steam turbines; (*c*) internal-combustion engines; and (*d*) water turbines; (2) steam boilers; (3) piston and centrifugal engines; (4) railway engines; (5) motor-cars and engines; (6) aeroplanes; (7) river craft; (8) complete equipment of industrial plant; (9) iron and steel constructional work and lifting gear; and (10) machinery for special purposes: (*a*) Road-making machinery; (*b*) crushing and pulverising machinery; (*c*) agricultural machinery; and (*d*) cigarette-packing machines.

(11) Tools and implements.

(*C*) *Electrical Engineering.*

(*D*) *War Material.*

(*E*) *Mining Products.*

The principal works is situated at Pilsen. Although we commenced at 7.30 in the morning, it was impossible to inspect the whole of this large works, and, beyond giving us an opportunity of walking through some of the large engineering shops, the visit was confined to the foundries and associated departments.

Steel Foundry.—There are seven fixed open-hearth furnaces with a capacity of from 35 to 60 tons each, and three electric furnaces, two with a capacity of 6 tons each and one of 15 tons. Some of the open-hearth furnaces are basic for ordinary steels; steels of a higher quality are made in acid open-hearth. One 6-ton electric furnace is used for making a 28 per cent. chromium steel for acid- and heat-resisting work, and the others are used for small steel castings. The whole of the steel for the foundries and for ingots is manufactured in this plant. All special ingots are treated by the "Harmet" process in a hydraulic press capable of a maximum pressure of 100,000 tons. The moulding floor of the foundry covers about 7,000 sq. metres.

The section of the steel foundry devoted to small castings was of particular interest. Moulds are made on press turn-over machines, and sand is supplied by an overhead conveyor with a hopper and shute over each machine. Each moulder in this section is provided with a short roller gravity conveyor alongside his moulding floor to assist in putting down the moulds. Steel snap-flasks are extensively used, and most of the moulds are of skin-dried green sand. Risers are cut off by oxy-acetylene torches and also by saws, of which there are several different types.

The Iron Foundry is one of the largest engineering foundries on the Continent. It is an enormous, well-lighted, clean and well-arranged building with plenty of room and an abundance of handling equipment. The melting plant consists of six cupolas, varying from 24 in. to 64 in. internal dia., and one 4-ton electric furnace which is used in connection with a duplex process for melting an abrasion-resisting iron for motor-car cylinders. We understand that this metal contains about 1.8 per cent. silicon and 0.3 per cent. tin. An acid-resisting alloy containing 16 per cent. silicon and a small quantity of titanium is also manufactured; both alloys are patented.

In this foundry, also, moulding machines are extensively employed, but, although numerous, fairly light castings are made in considerable quantity by hand, and there was little approach to so-called mechanisation. The core-making department is magnificently equipped with handling equipment, stores and benches; oil-sand cores are used almost exclusively for the lighter castings, and one noted certain oil-pump castings where chills were inserted in the cores to prevent porosity at vital points. A section of this foundry is devoted to the training of apprentices on ordinary production jobs selected according to their capability.

The Non-Ferrous Foundry is nearly 500 ft. long and 200 ft. wide; this also is quite a modern building. The melting equipment includes a Detroit rocking-arc furnace, numerous gas-fired furnaces and a number of ordinary pit furnaces. The total capacity of the melting plant is about 4½ tons. Additionally, there are gas-fired crucible furnaces for melting light alloys, with a total capacity of 1½ tons.

Die-casting is carried in a pressure die-casting machine, by a process which was comparatively new to the writer. The metal is melted but is never allowed to get thoroughly liquid, it is poured into the machine in a pasty condition by a hand-ladle. The dies are then subjected to a pressure from 180 to 200 atmospheres, and it is said that the output of the machines is 800 small castings per hr. The advantages claimed for this method are, soundness, longer life, more accurate finish and a saving in runners. An ingenious transfer system for the charging of core trays into the core ovens also aroused considerable interest.

All runners, risers, brackets, etc., in the Skoda foundries are standardised. Before any pattern is sent into the foundry it is examined by specialists, the position of runners, risers, etc., marked upon it, and the standards to be used are specified. It is claimed that considerable saving in defective castings is effected, and the lessons learnt from such defects can be made use of subsequently in an easy and systematic manner. The general tendency in the steel foundry in particular appeared to be in the direction of using a large number of smaller risers as against a smaller number of large ones.

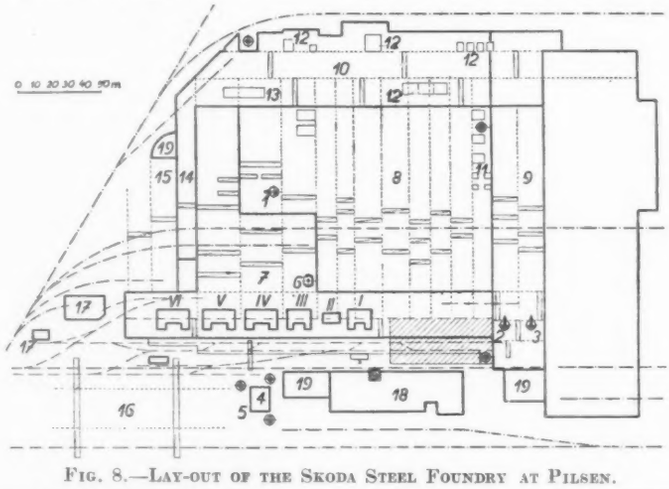


Fig. 8.—Lay-out of the Skoda Steel Foundry at Pilsen.

I to VI—Open-hearth furnaces. 1, 2, 3—Electric steel furnaces. 4, 5—Waste heat boilers. 6—Harmet press. 7—Casting pit for ingots. 8—Moulding shop. 9—Electric steel moulding shop. 10—Fettling shop. 11—Drying ovens. 12—Annealing furnaces. 13—Saws. 14—Pattern stoves. 15—Ingot mould stoves. 16—Stock yard. 17—Small stores. 18—Gas producers. 19—Offices.

The following production figures of these foundries are impressive:—

Steel Foundry.—Castings up to 80 tons. Annual output, 16,000 tons of steel castings, 5,000 tons of electric-steel castings and 100,000 tons of ingots.

Iron Foundry.—15,000 tons of castings per year.

Non-Ferrous Foundry.—1,500 tons of bronze and brass castings and 500 tons of light alloy castings per year.

The Pattern Shop.

One was particularly struck with the very high quality of patternmaking carried out in this shop. Patterns for the most part are well constructed and well finished. The shop is equipped with very modern machines, and two Wadkin Woodworkers are employed.

The pattern stores is the most amazing building of its kind the writer has ever seen. It is a new, well-built, well-lighted building of about eight storeys. Each set of patterns is carefully placed in a rack with a space between every two sets of patterns to prevent confusion. It is claimed that the expenditure of so much capital is justified in that the cost of repairing patterns and making good lost pieces before returning to the foundry has been almost entirely eliminated. A timber-drying plant is also operated. We did not see this, but we gathered it was similar to that at the C.K.D. works.

The Skoda Works operates a well-equipped school for the technical instruction of its apprentices. Foundry workers appear to receive instruction not only in practical matters such as gating and rising, but in reasonably advanced metallurgical subjects. Practical instruction in the making of large moulds is given with the aid of beautifully-made wood and plaster models of the moulds and cores made by the company. Instruction in safety-first methods is also carried out.

One cannot speak too highly of the lay-out, organisation, equipment and quality of the product of these magnificent foundries. Intelligent use is made of all modern equipment, though, as at the C.K.D. works, it appears to be considered desirable to instal equipment which is sufficiently flexible to cater for a very wide range of products.

The visit concluded with a very brief glimpse of the Metallurgical section of the Skoda Research Institute, probably one of the most completely equipped industrial research laboratories in Europe.

Fig. 9.—Part of the Skoda Non-Ferrous Foundry, showing Melting Plant.

Pilsen Brewery.

After the visit to the Skoda Works, the party proceeded to the most interesting works in Czecho-Slovakia, namely, the celebrated Citizen's Brewery at Pilsen. The ownership of this brewery is rather unique. Apparently it was the custom of the citizens of Pilsen to brew their beer at home; later a communal brewery was established, which was owned by the citizens themselves, and the ownership was then vested in the ownership of one's house.

The brewery has now developed into a large commercial concern with 1,500 employees, exporting beer all over the world. The ownership of the shares, however, is still vested in the freehold of certain houses in Pilsen, and many instances have been known of houses which have been sold for many times their value on account of the lucrative shares which they carry in this undertaking.

Water is drawn from two waterworks, one of which draws its supplies from the river, the other taps an artesian well. The water is filtered and a fountain artistically illuminated is shown to visitors, and is a very beautiful sight. The company is also responsible for the water supply of the entire town of Pilsen.

It is not proposed to describe the process of brewing, as the writer has no experience either as a manufacturer or consumer. One was impressed, however, with the enormous vats and cooling rooms. The storage rooms are hewn out of solid rock underground, and consist of 96 galleries, each of which is lined on both sides with enormous casks. There are 6,500 of these casks in use, and the total length of the galleries is six miles. The beer is kept in these cellars for three to four months at a temperature of 4 deg. C.

The bottle-washing plant is capable of dealing with 6,000 bottles per hour. The pitching of the barrels is carried out by an automatic plant working on a conveying system, and extensive and ingenious conveyors are also used in connection with the automatic barrel-washing plant.

Visits which took place simultaneously with the visits participated in by the writer included the famous Poldi works near Prague, which is engaged in the manufacture of special steels, and the works of Carborundum & Electrite, Limited. At Moravska Ostrava the alternative visit was to the works of the Mining & Ironworks Company at Trinec, which, it is understood, are similar to the Vitkovice works, but in some respects the equipment is more modern. At Brno, the Storek foundries were visited. This works possesses five cast-iron, malleable and steel foundries. The Engineering and Railway Carriage Works and the First Engine Works were also on the programme in this city. Some of the party also spent a very fascinating hour with Prof. Pisek in his laboratories at Brno, which, in addition to well-finished metallurgical laboratories, include a completely-equipped foundry.

On the concluding day of the Conference, the famous Kaolin quarries and refractory-materials factory at Horni Briza were visited. The writer is bound to confess that he rebelled against any more early-morning starts, and spent the day with a private party in visiting Carlsbad and

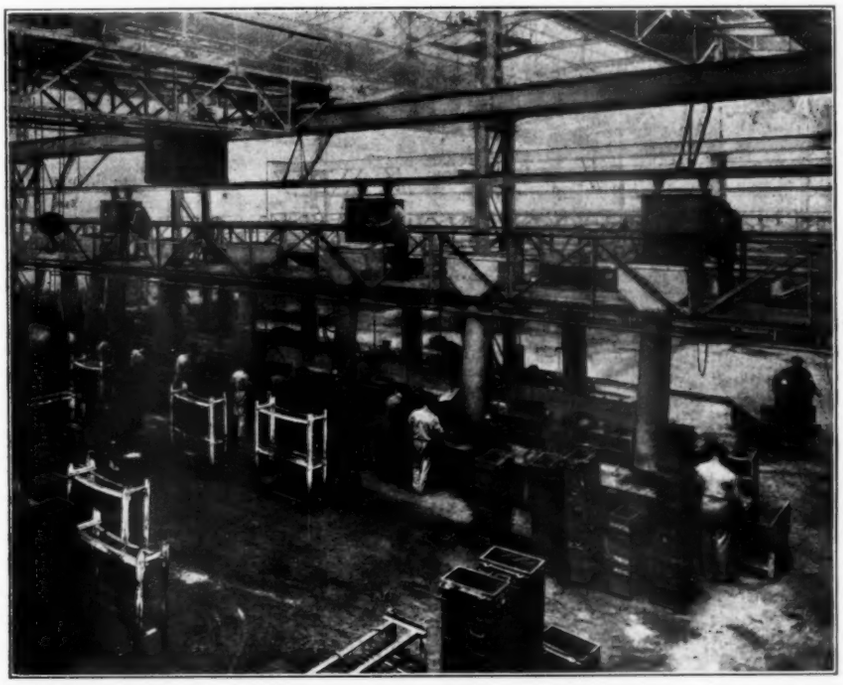


Fig. 10.—Bench-Moulding Plant at the Skoda Non-Ferrous Foundry, Pilsen.

Marienbad, an excursion which started from his hotel at the respectable hour of 9 a.m.

Costs.

It is difficult to compare costs of production in a foreign country with our own costs at home, due to difference and variations in the exchanges and different conditions. As far as could be ascertained, however, wages appear to be similar to, or even slightly higher than, wages paid in this country at the present rate of exchange, and, on the whole, there does not seem to be much difference in the cost of raw materials. We did find, however, that moulding sand could be purchased very cheaply. Excellent deposits of natural sand are available within easy access to the industrial centres, and the cost of sand delivered at the foundry works out at about five to six shillings per ton.

Papers.

It is impossible to summarise or even mention the whole of the forty Papers which were presented. Although only a total of six hours was available for the presentation and discussion of Papers, by the arrangement of simultaneous sessions, it was possible to allocate half-an-hour to each Paper. The Papers were issued in a bulky volume and were printed in the language of the author, and in every case in two other languages—French and Czech—whilst summaries were printed in other languages. Unfortunately, the sessions were not well attended, there being so many other distractions, but, in spite of the lack of discussion on the Papers, there is no doubt whatever of the value of such Papers at an International Conference. A conference does provide a stimulus to the preparation and publication of work which would not be carried out otherwise, the Papers are read and studied afterwards, frequently they are reprinted in the technical Press of many nations, and undoubtedly they do receive the attention which their importance deserves.

Visit to President Masaryk.

The President of the Republic of Czecho-Slovakia had intimated that he would receive a small representative deputation from the Congress at his country house at Topolcianky. Accordingly, seven members of the International Committee—Mr. Maas Geesteranus, President; Prof. Pisek, Vice-President; Mr. T. Makemson, Secretary; and Messrs. Leonard, Belgium; Magdelénat, France; Cameron, Great Britain and Delport, U.S.A., accompanied by Mr. Richtor, Secretary of the Conference—visited the President on Wednesday, September 13. The deputation left the Congress at Moravska Ostrava on the Tuesday afternoon, and rejoined the party at Brno on the following evening, having covered over 400 miles by an automobile in the meantime. The President is 82 years of age, but he is intellectually and physically as vigorous as most men many years his junior. He conversed informally with the deputation for an hour in English and French, the conversation being largely upon the development of his country and its effect upon the social life of the people, and he showed that he had a most intimate knowledge of the everyday life and problems of the workman and the peasant.

One fully appreciated the honour of a conversation with this wonderful man, and one's recollection of him will be that of a courteous and charming personality, keenly alive to the rapid changes of the present-day world, and by no means unsympathetic to many of the startling social changes of recent years.

Conclusion.

It would be ungrateful to conclude this account without acknowledging the great courtesy and hospitality of our hosts. Reference has already been made to the success of the organisation, but the pleasure and profit of our visit was enhanced by the extreme kindness we received from all connected with the Czechoslovakian Foundrymen's Association, and, in fact, from everyone we met. We were met on our arrival at Prague by Mr. Kraus, who made it his special mission to look after the comfort of the British party. Nothing was too much trouble for him and no task was too small if it contributed to our comfort. Mr. Kraus did not accompany us throughout the whole of the tour, but in his absence we were fortunate in having the friendship and help, and the cheery and lively personality, of Dr. Malkovsky, who was immediately co-opted as a "temporary" Britisher. Of Prof. Pisek one cannot speak too highly. He took upon himself the responsibility for the Conference organisation, and much of the work fell upon him. In spite of all his responsibilities, he remained unruffled and was an ideal host to every member of the Congress of fifteen nationalities. Finally, one must mention Mr. Maas Geesteranus, of Amsterdam, the President of the International Committee, whose adaptability and good-fellowship were great assets at all the business meetings and social functions. At one of the informal dinners Mr. Geesteranus decided to speak to the company in the language of everyone in the room, and the speech was made in eleven languages.

The Stobie Electric Jolt Moulding Machine.

Whilst revolutionary changes in methods of melting foundry metals, of preparing sands and of handling sand, moulds and castings have taken place during the last few years—changes which have made modern founding almost a different industry from what it was a few years ago—the

The Stobie Electric Jar-Ramming Machine.

improvements made in jolt moulding machines have been confined to modifications of accessory parts. No fundamental change in the basic method of operation has been offered and, until now, pneumatically-operated jolt moulding machines have held the field, almost exclusively, throughout the world.

It is not surprising to learn that the known high cost of pneumatic power has, since the early days of jolt moulding, turned experts' attention to the urgent need of devising a more efficient method of operating these machines. If it has not been done earlier, it is because the problem of jolt moulding is not merely that of how to lift a mould and drop it on an anvil. Had that been so, the many attempts which have been made to do this in the past by ingenious mechanical means would have been successful. There is, however, a multitude of unexpected and disconcerting failures which make all positive mechanical attempts foregone failures. Even the speed of lifting the mould prior to jolting affects the results!

An entirely new attack on the problem has been made by Mr. Victor Stobie, M.I.E.E., Past-President of the Institute of British Foundrymen, and we understand that a striking success has rewarded his work. The Stobie electric jolt moulding machine lifts the moulding box, pattern and sand at a speed which is claimed to accord exactly with theoretical requirements. The jolting of the materials on the anvil also follows laws essential for perfect ramming and produces a shock which is truly dead, without any subsequent jarring vibration to spoil the work performed by the controlled jolt. The machine jolts at a speed limited only by considerations of physical laws and the results sought; the time required to complete a mould is thus shortened to the minimum practical limit.

Moulds have been made on the Stobie jolter with, at most, $\frac{3}{4}$ in. of sand between the moulding box and a 5-in. deep right-angle corner of a pattern, which have been pronounced by foundry experts to be entirely uniform from top to bottom of the $\frac{3}{4}$-in. thick sand. This pattern was stated to be the worst one for moulding of all the patterns in a large jobbing foundry. Such uniformity expresses the result of scientific moulding in a manner easily appreciated by the foundryman.

The force of impact of a jolt moulding machine should be variable by the moulder, for two reasons. Firstly, it is oftimes better to give a gentle first jolt or two to a mould before proceeding with the heavier jolting, so that the sand may close in on the mould without the formation of small pockets due to air traps. Secondly, different patterns are, frequently, better moulded by different values of shock. The Stobie jolter provides instant adjustment of jolt value by means of a small handwheel, part of the rim of which can be seen at the right-hand side of the machine shown in the accompanying illustration. The adjustment is made as easily and as safely with the machine working as when it is at rest. The wheel may be removed to any position away from the machine if remote control be desired.

The operating of the Stobie jolter is, as with all modern electrical plant, reduced to the utmost simplicity. When the moulding box is on the table and ready for jolting, the operator just presses a push-button. When he desires to stop the machine he presses another push-button. That is all that is necessary. The two push-buttons, mounted together, are put wherever convenient for the operator.

For repetition work, or in any other case when a definite amount of jolting is required for each mould, an attachment is made to the electric circuit of the Stobie jolter, which automatically stops it after the desired work is done. By this arrangement, the operator has only to push the starting button, and is relieved of any further attention of this nature until he pushes the starting button again when the next mould is ready for jolting.

The consumption of power for operating this new machine is said to be less than one-quarter that used for pneumatic moulding plant. Other advantages are the absence of water condensation and of rust, which are, to a certain extent, unavoidable with pneumatic power. There is further economy, compared with the old system, in the absence of pipe-line losses; cooling water for a compressor, compressor maintenance and lubricants, and other items which will occur to the founder.

The new plant, being independent of separate auxiliaries, can be placed where convenient in a foundry, without regard to the position of any other equipment than cupola or conveyor.

A new era has, probably, been ushered in by the Stobie jolter in foundries which, either by reason of the greater part of their output being of a nature not calling for jolt-moulding machines, or by reason of their small size, have not previously installed a machine because of the capital cost and inconvenience of having an air compressor, receiver, air and water pipe-lines, etc., for a single machine. Now that this jolt-moulding machine can be had as an independent unit and operate as economically as if a dozen were installed, the foundry having use for only one machine can come into very effective competition with the largest foundries equipped with a multitude of pneumatic machines. Further details of the Stobie jolter may be had by application to the Stobie Metallurgical Construction Company, of Soho Foundry, Meadow Road, Leeds.

Influence of Beryllium on Steel.

By J. H. S. Dickenson and W. H. Hatfield, D.Met.

(*Abridged.*)

(*Concluded from page 222.*)

18 per Cent. Chromium, 8 per Cent. Nickel Austenitic Stainless Steels.

Macro-Examination.—Sections cut from the top and bottom ends of the ingots, as in the previous cases, were etched in a mixed solution of hydrochloric and nitric acids at 80 deg. C., but there was no pronounced difference between the two ingots. The beryllium-bearing ingot showed a less developed columnar wall, but the differences were such as might occur in any pair of crucible ingots of this type of stainless steel.

Critical Changes.—Ingot No. 18,127, without beryllium, showed no change points whatever, but the beryllium-bearing steel gave the unusual heating and cooling curve shown by Fig. 1, with indications of four change points on cooling at 1,040 deg. C., 915 deg. C., 878 deg. C. and 630 deg. C.

Forging, Heat-Treatment and Mechanical Testing.—The forging of No. 18,127 was commenced at 1,100 deg. C., and after a light pass the ingot was hammered at one end to about 1⅛ in. dia. It was returned to the furnace and brought out again at 1,150 deg. C., and swaged without difficulty to 1⅛ in., finishing at 1,000 deg. in the swages. The rest of the ingot was reheated to 1,150 deg. C. and taken in one operation to 2⅛ in. round and swaged, finishing at 900 deg. C.

The forging of No. 18,128 was commenced at 1,150 deg. C., but, after a light pass, was returned to the furnace, and forging was tried at 1,100 deg. C. The material was stiffer than the previous ingot, and there was a tendency for the ingot to split at the base. Two reheats were required and it was necessary to use lighter hammer blows. The upper part of the ingot was taken down to 1⅛ in. and swaged. The second half of the ingot was reheated to 1,100 deg. C. and forged down to 1⅛ in. dia. and swaged in three operations, finishing in the swages at 950 deg. C.

Table III.—*Brinell Results on Austenitic Stainless Steels after Heat-Treatment.*

Heat-treatment.	Brinell No.	
	No. 18127.	No. 18128.
Air-cooled 950 deg. C.	203	303
Muffle-cooled 950 deg. C.	201	307
Water-quenched 800 deg. C.	196	316
" " 850 "	203	302
" " 900 "	206	285
" " 1,000 "	196	285
" " 1,050 "	200	329
" " 1,100 "	178	320
" " 1,150 "	170	316
Air-cooled 1,150 deg. C.	194	269
Water-quenched 1,100 deg. C., tempered 300 deg. C.	177	293
Water-quenched 1,100 deg. C., tempered 400 deg. C.	174	341
Water-quenched 1,100 deg. C., tempered 500 deg. C.	176	409
Water-quenched 1,100 deg. C., tempered 600 deg. C.	178	351
Water-quenched 1,100 deg. C., tempered 700 deg. C.	191	341

Pieces of bar from each ingot were first tested in the forged condition, and after water-quenching from 950 deg. C., when the Brinell numbers obtained were 207 and 198, respectively, from the normal ingot and 273 and 281, respectively, from the beryllium-bearing ingot. After this, Brinell hardness numbers were obtained after a variety of heat-treatments, with the results shown in Table III.

Later a series of test-bars was heat-treated, and tensile and impact tests were made with the results contained in Table IV.

Comparison of these results shows very definitely that while, after each of the various heat-treatments applied, both the yield point and maximum stress of the steel containing beryllium are much higher, the reduction in the ductility and toughness is very considerable indeed, the beryllium-bearing steel being, in fact, definitely very brittle in comparison with the tough normal austenitic steel.

Micro-Examination.—Specimens were first prepared from forged test-bars and etched in nitro-hydrochloric solution at 80 deg. C., but, whereas the normal 18/8 steel required an immersion of 30 sec. to complete the development of the structure, only 15 sec. were needed to produce the same effect in the beryllium-bearing steel. After air-cooling from 1,100 deg. C., steel No. 18,127 consisted wholly of austenitic grains, which were considered to be of normal size according to the heat-treatment applied, but the corresponding beryllium-bearing steel showed a complete breakdown of the austenitic solid solution, resulting in a two-phase structure similar to that normally met with in stainless steels of high-chromium and low-nickel content, the dark constituent being apparently pearlitic in character.

Corrosion Tests.—The tests tabulated in Table V were carried out over a period of 24 hrs. on fully-softened cylinders in the polished condition. Except for minor differences, the results for the austenitic chromium-nickel steel without beryllium are quite normal for this class of steel, while those of the beryllium-bearing steel show, without exception, resistance of a much lower order. A test in sea-water under alternate wet and dry conditions for 4 hrs. caused a trace of rust to appear at a few points in both steels, and there was little, if any, difference between the appearances of the two specimens.

3.6 per Cent. Nickel Steels. Ingots A and B.

Macro-Examination.—No essential structural differences were shown by the top and bottom end sections cut from these ingots, although, of the two, the beryllium-bearing ingot was distinctly less sound at the top end towards the central axis.

Critical Changes.—The normal 3½ per cent. nickel steel *A* showed a well-defined arrest reaching a maximum at 794 deg. C., with an upper change terminating at 750 deg. C., whilst, on cooling, the upper critical change commenced at 650 deg. C., and reached a peak at 631 deg. C., Ar_1 occurring quite sharply at 598 deg. C. The beryllium-bearing steel showed a much less well-defined series of critical changes, but otherwise there was no essential difference in character. Ac_1 reached a peak at 731 deg. C., whilst the peaks of $Ar_{3,2}$ and Ar_1 were also rather higher than normal, at 693 deg. C. and 652 deg. C., respectively.

Forging, Heat-Treatment and Mechanical Testing.—Both ingots forged reasonably well at initial temperatures of about 1,155 deg. C., finishing at about 900 deg. C., but the beryllium-bearing ingot was considered to have forged rather "harder" than its companion, and showed traces of "bursting" at the top end of the bar. The upper half of the ingot was drawn down under the hammer to 1⅛ in. dia. and the lower half to 2⅛ in. dia.

A considerable programme of heat-treatment and mechanical testing was carried out on the forged bars from these two ingots on account of the important *rôle* played by nickel steels in aircraft production, and are described in the original **Paper.**

Table IV.—*Physical Tests.*

Heat-treatment.	Tensile tests. Gauge length: 2 in. × 0.564 in. Yield point. Tons per sq. in.	Max. stress. Tons per sq. in.	Elongation. Per cent.	Reduction of area. Per cent.	Izod impact. Ft.-lbs.
Cast No. 18127—					
As forged	20.0	52.4	46.7	41.0	—
A.-C. 900 deg. C.	24.9	57.7	30.0	29.7	—
A.-C. 1,150 deg. C.	23.8	54.5	40.0	37.5	117, 113, 111.
A.-C. 1,150 deg. C., reheated 800 deg. C. for 2 hours A.-C.	20.0	60.1	30.7	31.6	105, 88, 78.
A.-C. 800 deg. C., after 2 hours at temp.	27.4	64.7	2.8	31.6	—
Cast No. 18128—					
As forged	47.7	63.6	16.7	19.5	—
A.-C. 900 deg. C.	53.4	71.5	8.7	11·0	—
A.-C. 1,150 deg. C.	39.6	62.0	20.0	27.5	5, 5, 5.
A.-C. 1,150 deg. C. reheated 800 deg. C. for 2 hours A.-C.	60.7	75.5	9.3	15.0	4, 5, 3.
A.-C. 800 deg. C., after 2 hours at temp.	56.9	75.1	13.3	25.8	—
W.-Q. 1,150 deg. C.	—	76.5	1.5	2.0	—

Table V.—*Results of Corrosion Tests.*

Reagent.	Temperature deg. C.	Loss. Grms. per sq. cm. No. 18127.	No. 18128.
5 per cent. sulphuric acid	20	0.0029	0.0502
50 per cent. sulphuric acid	20	0.0401	0.3340
Saturated (20 deg. C.) $(NH_4)_2SO_4$ + 5 per cent. H_2SO_4 (1)	60	0.0066	0.0720
(2)	60	0.0049	0.0955
50 per cent. citric acid (1)	B.p.	0.0000	0.0960
(2)	B.p.	0.0000	0.0964
B.P. acetic acid (1)	B.p.	0.0016	0.0545
(2)	B.p.	0.0042	0.0152
Nitric acid (sp. gr. 1.42)	B.p.	0.0030	0.4030
Nitric acid (sp. gr. 1.20)	B.p.	0.0003	0.0598

Consideration of Specific Test Results.

There is much of interest to be gained by further study of the two beryllium-bearing steels of the 3½ per cent. nickel steels and nickel-chromium steels with and without beryllium, but it is equally clear that a remarkable phenomenon exhibited by both these materials on tempering at 500 deg. C. makes them quite useless in relation to the specific object of this investigation, that is to say, in connection with aircraft construction.

XUM

The temper-hardening, which, both in the 3½ per cent. nickel steel and in the nickel-chromium steel, results in a high degree of brittleness and liability to crack during cooling after tempering, would appear to be due to some form of "ageing" or carbide precipitation. Micro-examination suggested that the increased hardness obtained at 490 deg. C. was probably due to the precipitation of carbides of beryllium, but circumstances have not permitted this aspect of the matter to be explored. Other investigators have obtained somewhat similar results with steels containing beryllium, and Ehn has referred to an alloy steel containing 4 per cent. of beryllium which gave a Brinell hardness number of only 205 when quenched at 1,000 deg C., this rising to 645 after tempering at 300 deg. C.

TABLE VI.—*Analysis of Silicate, per cent.*

Ingot.	Steel.	Silicate.	Analysis of silicates.				
			SiO_2.	Al_2O_3.	FeO.	MnO.	BeO.
A	3½ per cent. Ni steel	0.027	50.5	45.0	4.0	—	—
B	3½ per cent. Ni steel + Be ..	0.010	67.0	8.0	8.0	Trace	16.0
C	Ni–Cr steel	0.022	37.7	57.0	4.6	1.0	—
D	Ni–Cr steel + Be	0.010	50.0	5.0	17.6	Trace	24.0

Non-Metallic Impurity in Beryllium Steels.

Samples removed from the bottom ends of the two 3½ per cent. nickel steels (ingots *A* and *B*) and the two nickel-chromium steels (ingots *C* and *D*) were dissolved for the separation of silicates, using the method suggested by one of the authors. The results given in Table VI were obtained.

These results were unexpected, as micro-examination had suggested that the two beryllium steels were decidedly less "clean" than the companion ingots, and it seems probable that a considerable proportion of non-metallic matter present in the two beryllium steels had dissolved during the process of separation. Apart from this, the differences in composition of the separated residues are interesting, especially the considerable displacement of Al_2O_3 by BeO in beryllium steels. It should be noted that no aluminium had been added to the steel, so that the Al_2O_3 comes from the pot.

Conclusions.

The results disclosed by this investigation indicate little or no prospect of the element beryllium becoming a useful addition to the group of metals used in the manufacture of special steels. The metal is extremely expensive, and is unlikely ever to become reasonably cheap, whilst its lightness and readiness to oxidise make the actual introduction into molten steel somewhat difficult and distinctly wasteful, even with the special method of addition employed in the present case.

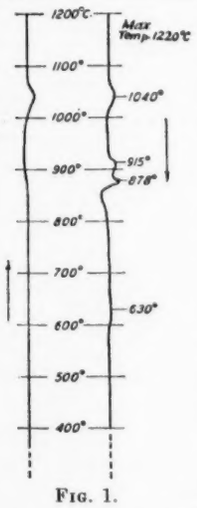


FIG. 1.

As regards forging, the addition of 1 per cent. of beryllium tended to make some of the steels, particularly the 3½ per cent. nickel and the nickel-chromium steels, distinctly "stiffer" under the hammer, with an increased tendency to "burst," especially towards the top end, but it is probable that this would give rise to no serious manufacturing difficulty if the beryllium steels were required for use in engineering construction because of their desirable physical properties. In this respect, however, the addition of beryllium has proved harmful rather than otherwise.

Apart from the hardness peak in the tempering range 400 deg. to 450 deg. C. and the associated brittleness and the liability to crack with rapid cooling, probably due to some pronounced volume change, the beryllium-bearing steels show throughout a marked liability to fragility, as evidenced by the impact test, which far outweighs the increase in tensile strength. In short, none of the steels containing beryllium has shown, with any treatment, the combination of high-elastic limit and fatigue resistance with ductility and toughness, which is necessary in highly-stressed engine parts. It was thought that the addition of beryllium might confer upon stainless steels of the 18 per cent. chromium, 8 per cent. nickel type, which are normally austenitic, an increased resistance to corrosion, but in this case also the results were definitely disadvantageous.

Wear of High-Duty and Alloy Cast Iron.

In a recent issue of "Die Giesserei"*, MR. R. KNITTEL has described a new method of determining the wear of cast iron. A cylindrical test-piece 10 mm. in dia. and about 50 mm. in length rotates around the vertical axis and is pressed with its lower face against a fixed cast-iron plate 30 mm. square and 10 mm. thick. The wear is measured by the loss in weight of both cylinder and plate. The advantages of this method, as claimed by the author, are the following:—(1) Both the total wear and the partial wear which each of the two test-pieces suffers can be measured; (2) the samples can be easily cut; (3) testing takes only 10 minutes; (4) the accuracy is within the range of ± 10 per cent.; and (5) the interaction between working and fixed part can be studied.

Proceeding from a high-duty cast iron of pearlitic structure, the effect upon the wear of the common elements and of nickel and chromium were investigated. The pressure with which the cylindrical test-piece was pressed against the plate was 24 kg./cm.² and the revolving speed 325 r.p.m. The testing time (10 min.) was measured from the moment when the first abrasion dust appeared. The tests were made without lubricant. The effect of the factors investigated was as follows:—

I.—*Carbon and Silicon.* By reducing and increasing the silicon content of the original material four irons were obtained containing carbon from 3.15 to 3.5 and silicon from 1.15 to 2.3 per cent., and having an average Brinell hardness of 183, 229, 231 and 243 respectively. Each of these irons was tested against the three others, being now the moving, now the fixed part. The wear is dependent on the difference in hardness between the moving and the fixed part, being a minimum when the difference is nil. The wear is lower when the moving part is harder than the fixed part. The decrease in wear is not proportional to the increase in hardness, when both parts have the same hardness. Thus, by increasing the hardness by about 25 per cent., the wear was only reduced by about 8 per cent. The effect upon the wear of the difference in hardness is the greater the stronger the iron. The graphite shall be present in long, thin flakes. Short, thick flakes are detrimental. The graphite eutectic somewhat increases the wear, because it is embedded in the soft ferrite. The wear is the same whether the iron is cast in a dry or green-sand mould. Silicon when added in the ladle gave an iron of higher wear than when introduced into the mixture. The wear rapidly rises from 1 to 1.5 per cent. of silicon, then more slowly. Annealing at 900 deg. C. softens the structure and increases the wear considerably.

II.—*Manganese.* Up to 1.22 per cent. Mn the wear remained the same, and was reduced by about 7 per cent. by further increasing the manganese content up to 1.65 per cent. Due to the more stable manganese carbide, the wear of the annealed samples was somewhat reduced by increasing manganese content.

III.—*Phosphorus.* Irons containing up to 1.92 per cent. P (Brinell hardness 245) were tested. The wear is greatly reduced up to 1 per cent. P, then more slowly. Thereby it is indifferent whether the phosphorus containing material is the moving or the fixed part. At 1.92 per cent. P the decrease in wear was 30 to 40 per cent., depending on the hardness of the other part, the latter figure being found with the softer irons. The beneficial effect of phosphorus is bound to a pearlitic structure. Ordinary iron with a high-phosphorus content is inferior to a pearlitic iron with a lower phosphorus content. Annealing at 900 deg. C. decomposes the structure into ferrite and graphite, with a consequent high increase in wear. Only the iron containing 1.92 per cent. P gave good results in the annealed state.

IV.—*Nickel.* In spite of the high increase in hardness, up to 4 per cent. nickel had no effect. In some cases even a slight increase in wear could be stated from 0.2 to 0.6 per cent. Ni. The structure is not stabilised by nickel, and, on annealing, decomposes into ferrite and graphite.

V.—*Chromium.* At contents higher than 0.4 per cent. chromium reduces the wear, the decrease being about 25 per cent. with 0.7 per cent. Cr. After annealing at 900 deg. C. the samples containing over 0.4 per cent. Cr showed about the same wear as the unannealed samples. When nickel and chromium are added the effect depends solely on the chromium content.

VI.—*Elevated Temperatures and Surface Condition.* Up to 250 deg. C. the working temperature had no effect upon the wear of the irons tested, with the exception of the material containing 1.92 per cent. P, which showed a gradual increase in wear. At 250 deg. the wear was by 25 per cent. higher than at room temperature. The degree of surface finish must be the higher the harder the iron.

* Nos. 29/30, 31/32, and 33/34.

"They Cannot Read This."

Many years have passed since the Great War, and some of us are apt to think of that period as a slate wiped clean. Wounds have healed—but we forget that blindness remains, and increases.

The eighteenth annual report of St. Dunstan's, significantly entitled "They Cannot Read This," strikes an optimistic, cheerful note. Interest and —in spite of hard times—financial support, continue to be widespread and generous, so that St. Dunstan's has passed through an anxious but, on the whole, satisfactory year. Help goes out from St. Dunstan's to two thousand families all over the Empire. Help with their work, by finding employment and markets for professional men and craftsmen; help with their pensions, in legal or other difficulties; financial assistance in cases of need, and a wonderfully organised medical service and convalescent home at Brighton. But the war against war-blindness will not end for 40 years—until the last blinded soldier has passed away. To ensure life-long care of every blinded soldier requires, as the report points out, the building up of a fund while the memory of the war is still in the public mind. In ten years' time the war will have been over for a quarter of a century. The report convinces the reader that support for St. Dunstan's is support for a worthy and well-managed cause.

This Week's News in Brief.

Trade Talk.

Murex, Limited's offer of 76,966 ordinary shares to shareholders has been largely oversubscribed.

The Brazilian Embassy has received from the Brazilian Government the specifications relating to the tender for the new naval programme, which may be consulted at the Embassy, 19, Upper Brook Street, London, W.1.

The Import Duties (Drawback) (No. 14) Order, 1933, issued by the Treasury, provides for the allowance of drawback of Custom duties for a period of three months in respect of coin blanks of nickel metal used in the manufacture of foreign nickel coinage.

The University of Birmingham Metallurgical Society has now printed its programme for the Winter Session. It includes ten works visits and nine Papers. A feature is the alternation of lectures by recognised authorities and students working in the department. Mr. P. L. Lockyer is the hon. secretary, and his address is The University, Edgbaston, Birmingham.

Messrs. Palmers (Hebburn) Company, Limited, have secured the contract for grafting a new middle on the Blue Star liner "Doric Star," which is expected to provide work for several hundred men for three months. The work involves lengthening the vessel by 30 ft., by fitting a new stem or centrepiece after the present one has been cut away. It is reported that the Blue Star Line is considering reconditioning other vessels of their fleet shortly, the contracts for which local firms are hopeful of securing.

An accident occurred in the Columbian Stove Works of Messrs. Smith & Wellstood, Limited, Bonnybridge, as a result of which two moulders were severely burned. The men were employed in the boiler section, and were about to pour from a two-handled shank. Pieces of cold metal were dropped into the ladle to cool the metal, when an explosion took place, and the metal flew up to the roof and splashed over the two men. Both men will be incapacitated for some time. The wooden roof beams caught fire and assistance had to be summoned to extinguish the flames.

A company of nearly 100 members and guests assembled in the works canteen on October for the social meeting and presentation of prizes of the Bowling Club of Messrs. John G. Stein & Company. The club President, Mr. Neil Munro, presided, and was supported by Colonel Alan Stein and other prominent members. After tea Colonel Stein, in proposing the toast of the club, congratulated the members on the fine season that had just closed, and wished the club every success in the future. The prizes were presented by Mrs. Munro, and afterwards the members engaged in a whist drive and domino competition, followed by a dance.

At the opening meeting of the session of the Glasgow and West of Scotland Association of Foremen Engineers and Draughtsmen, on October 14, Mr. A. T. Riley, of Messrs. Alexander Stephen & Sons, Limited, delivered his presidential address. He was optimistic as to the future of trade and industry. Commenting on the present state of world trade, Mr. Riley said that it was an admitted fact that the world was better equipped to-day than ever before; the world was much richer, and he believed that the present blight of poverty which was harrassing mankind was artificial and was not beyond the power of human intelligence to solve. Periods of depression almost as distressing and exasperating to the people of the time had occurred before, and they had been succeeded by periods of prosperity. Reviewing the progress of marine engineering, Mr. Riley, in his address, dealt at length with the installation and operation of turbine machinery for marine propulsion.

Intimation has been made that the Clydesdale Steel Works at Mossend, belonging to Messrs. Stewarts and Lloyds, will close down on December 30. A number of the employees, engineers and fitters are leaving for Corby immediately, as their services are required in connection with the development work there. The closing of the Clydesdale works follows on an arrangement which has been made between Messrs. Stewarts and Lloyds and Messrs. Colvilles, Limited, whereby the latter firm will take over the steel-plate business of Messrs. Stewarts and Lloyds in Scotland and export markets of the world. The modern universal plate mill at Clydesdale works will be reconstructed for use as a blooming mill and transferred to the new works at Corby. The supply of steel plates for the manufacture of heavy pipes required by Messrs. Stewarts and Lloyds will be obtained from the Clydebridge works at Cambuslang of Messrs. Colvilles, Limited, for a period of years in a manner satisfactory to both firms. The new agreement is intended to come into operation at the end of the present year. The new arrangement constitutes another step in the unification of the Scottish steel trade, and is possibly the most important development which has taken place in Scotland since the necessity for reorganisation of the industry became generally recognised.

A visit was paid by the members of the Scottish branches of the Mining Electrical Engineers' Association to the works of Carron Company, Falkirk, on October 14. The party of about 150 witnessed the casting of pig-iron at the blast furnaces, afterwards inspecting the turbo-blowers and boiler and power-station plant. The enamelling departments were visited, where an exhibition of the company's products was laid out. The party then proceeded to the dressing and moulding shops, and the electrical cooking and heating departments, where they had an opportunity of inspecting a comprehensive range of electric fires, tubular heaters, etc., and a complete range of domestic cookers. The party adjourned to the Welfare Hall at Mungal Foundry, where they were entertained to tea. Mr. J. R. Laird, President of the West of Scotland Branch, presided, and was supported by the President and secretaries of the Lothians and Fife Branches. Extending a welcome to the members of the Branches, Mr. Laird said he did so on behalf of Mr. George Pate, manager of Carron Company, who was unable to be present. Mr. David Martin, O.B.E., a Past-President of the Association, proposed a vote of thanks to Carron Company and Mr. George Pate for the privilege of visiting the works and for their hospitality. Mr. J. R. Laird then delivered his presidential address, in which he dealt very largely with the question of training apprentices.

Contracts Open.

Rugby, November 3.—Water pipes and specials, for the Rural District Council. The Surveyor, Temple Street, Rugby.

Slough, October 23.—3-in., 4-in. and 6-in cast- or spun-iron pipes, for the Urban District Council. The Water Engineer, Council Offices, Slough.

Cowes, October 25.—776 yds. of 3-in. C.I. pipes, for the Urban District Council. Mr. J. W. Webster, water engineer, Northwood House, Cowes, I. of W.

Cairo, December 18.—7,500 metres of C.I. pipes, for the Egyptian Ministry of Public Works. The Department of Overseas Trade. (Reference G.Y. 13,043.)

Richmond, Surrey, October 25.—67 tons of 9-in. dia. cast-iron pipes (or for 960 yds. of spun pipes) and special castings, for the Town Council. Mr. H. P. Williamson, water engineer and manager, Hotham House, Heron Court, Richmond, Surrey. (Fee £2, returnable.)

New Companies.

British Direct Steel Company, Limited.—Capital £10,000. Steelmakers (particularly by direct process). Subscriber: D. D. C. Giddins, 7 and 8, Great Winchester Street, London, E.C.2.

International Consolidated Steel Trust, Limited.—Capital £6,000. To acquire and turn to account any invention relating to the manufacture of steel by direct process. Subscriber: D. D. C. Giddins, 7 and 8, Great Winchester Street, London, E.C.2.

Company Report.

Steel Industries of Great Britain, Limited.—No dividend has been received during the year ended September 30 last from the United Steel Companies, Limited, and the accounts show a loss of £12,108, increasing the total debit to go forward on profit and loss to £29,206.

Personal.

Mr. R. Jakeman has completed 21 years' service as Sheffield district manager of the British Oxygen Company, Limited, and on Tuesday he received several presentations in commemoration of the event.

Mr. E. G. Martyn, J.P., ironfounder, Wadebridge, has been appointed by the Cornwall Court of Quarter Sessions as one of the visitors of institutions in the county under the Lunacy and Mental Deficiency Acts.

At the Chattan Iron Foundry of Messrs. Mitchell Russell & Company, Limited, Bonnybridge, last Friday, in token of the esteem of her colleagues and to mark the occasion of her approaching marriage, Miss C. Mitchell was presented with a display cabinet and lady's chair. Mr. M. Dick, in making the presentation, expressed the wishes of her follow workers for a happy and prosperous future.

A large gathering of officials and members of the Lanarkshire Blacksmith Association met in the Abbeygreen Hotel, Lesmahagow, on October 14, to do honour to their oldest member, Mr. John Dodds, of Lesmahagow. After tea, Mr. John M'Rae, President of the local branch, occupied the chair, and called upon Mr. Wotherspoon, of Messrs. Martin & Company, Glasgow, to make a presentation of a wallet of notes. Mr. Wotherspoon referred to the long connection of Mr. Dodds with the Association, being a member since its inauguration over 20 years ago, and to the fact that Mr. Dodds had been 69 years in the trade, having only just recently retired in his 82nd year.

Will.

M'Gregor, Alexander, of Newmains, works manager of the Coltness Iron Company, Limited, Newmains ... £4,979

Company Meeting.

Neepsend Steel & Tool Corporation, Limited.

Presiding at the annual meeting of the Neepsend Steel & Tool Corporation, Limited, Sheffield, Mr. S. C. Goodwin said that although last year's results were exceedingly good, he could prophesy a further improvement next year. They had decided to make a big outlay on further plant to keep fully abreast of the times, and they were employing more people and had a larger wage-bill than at any other period in their history. Before the application of Safeguarding to the steel industry even the most efficient firms found it difficult to operate without a loss. Safeguarding had been the means of increasing the number of people employed and also the spending power of the employees. He could not recall a single instance where the prices of products manufactured by the Corporation had been increased through Safeguarding, but there were many instances where costs had been reduced.

Obituary.

The death occurred, on October 19, at his residence in Dalmuir, of Mr. John Paterson, of Messrs. John Brown & Company, Limited, Clydebank. A native of Duntocher, Mr. Paterson entered the employ of Messrs. John Brown & Company as a lad, and ultimately became local director, having in all 50 years' service with the firm.

The death occurred suddenly, on October 18, of Mr. Denis Fearnside, a member of the firm of Messrs. Samuel Fearnside & Sons, ironfounders, of Sunderland Street, Keighley. Mr. Fearnside had gone home for his lunch apparently in the best of health. Before returning to business he went upstairs, and a few minutes later he was found dead. Death was due to heart failure. He was 59 years of age, and leaves a widow and one son. He was a member of the West Yorkshire Branch of the Institute of British Foundrymen.

We sincerely regret to announce the death, last Friday, of Mr. W. Donnan, the sand-foundry superintendent at Messrs. Lightalloys, Limited, of Willesden, manufacturers of Alpax alloys. Before joining Lightalloys, Mr. Donnan was foreman over the brass foundries of Armstrong-Whitworth at Elswick. He joined the Institute of British Foundrymen in 1928, and participated in the Italian international conference in 1931. His son is a junior member of the staff of the British Non-Ferrous Metals Research Association.

Raw Material Markets.

Although export trade does not show improvement, steady conditions rule in the domestic iron and steel markets. New orders for pig-iron are not numerous at the moment, as many consumers are covered to the end of the year and further. Satisfactory deliveries are being made under running agreements. Many consumers are definitely busier, but the inactivity at many shipbuilding yards and heavy engineering works still acts as a check upon general recovery. Pig-iron prices are very firm. An increase of 2s. 6d. per ton has been made in the price of East-Coast hematite. Scrap-iron and steel prices are also moving upwards.

Pig-Iron.

MIDDLESBROUGH.—There is a strong demand for Cleveland foundry iron, but business is restricted by the smallness of the spillover after the makers have satisfied their present commitments, to do which they are, in many cases, having to make heavy withdrawals from stock. As the latter are approaching exhaustion, an increase in the production seems inevitable. The makers are reluctant to put furnaces into operation, however, while there is such a scarcity of coke, prices of which continue to rise. No increase has been made in iron prices and none is expected at present. The official quotations for No. 3 Cleveland G.M.B. foundry pig-iron remain at 62s. 6d. per ton delivered Middlesbrough, 64s. 6d. delivered North-East Coast, 62s. 3d. delivered Falkirk and 65s. 3d. delivered Glasgow. A premium of 2s. 6d. is charged for No. 1 foundry grade and a discount of 1s. is allowed on No. 4 foundry or No. 4 forge iron.

The price of East-Coast hematite has been raised by 2s. 6d. per ton to 62s. 6d. for mixed numbers and 63s. for No. 1 quality. There is a heavy demand from steelmakers in Sheffield and South Wales, and the production of the seven furnaces now in blast is fully absorbed. Stocks are being rapidly reduced. Another factor contributing to the strength of the market is the rise in coke and ore prices, although this rise may not have affected production costs as yet, owing to makers having long-term contracts with their suppliers.

LANCASHIRE. — Conditions in Lancashire are said to be slightly improving by the Midland ironmasters, who report a better volume of deliveries to consumers. Up to the present, new buying of foundry iron has been rather slow, but the market is showing a very firm tone. Prices are fully maintained, with Derbyshire and Staffordshire brands of No. 3 both quoted for delivery to users in the Manchester zone on the basis of 67s. per ton. North-East Coast iron for delivery in the district is also nominally quoted at this figure, but Cleveland producers have little material to spare. Northants is maintained on the basis of 65s. 6d., with Derbyshire forge at 62s., Scottish foundry at about 80s., and West Coast hematite at up to 81s.

MIDLANDS.—Slightly more activity is reported in the heavy engineering trades in this area. There is a satisfactory general demand for pig-iron and Midlands makers are experiencing a turnover in excess of their current output. The bulk of the iron that is being brought into this area is for the light-castings trade. No change in prices has taken place. Northants No. 3 is 62s. 6d. and Derbyshire, Lincolnshire and North Staffordshire No. 3 are 66s. per ton delivered Birmingham and Black Country stations, subject to rebate for consumers of large tonnages. There is no difficulty about getting supplies of No. 3 foundry iron, because of the stocks held by the furnaces. Small quantities of Cleveland iron are coming through at round about 72s. 6d. per ton. There is no foreign iron being imported, as the price is not competitive. Scottish No. 3 is at 85s. per ton and medium-phosphorus irons from other areas vary between 70s. and 80s., according to the carriage, with low-phosphorus grades between 80s. and 90s., delivered this district. Refined pig-irons for special trades vary, according to analysis and tonnage, from £5 to £6 15s. per ton delivered.

SCOTLAND.—Busy conditions continue in the light-castings trade, but otherwise conditions in the consuming industries are not satisfactory. Hand-to-mouth buying is the rule, except in the case of Cleveland iron, which has been bought well forward. For Scottish iron there is no change to report in prices. No. 3 foundry remains at the official minimum of 65s., f.o.t. furnaces, with 2s. 6d. extra for No. 1. There is still no indication of any further increase in production. No. 3 Middlesbrough is at 62s. 3d. f.o.t. Falkirk area and 65s. 3d. f.o.t. Glasgow area, but the makers are not pressing sales.

Coke.

In spite of the general firmness of the coke market, there has as yet been no rise in the prices of foundry grades. Consumers are, however, apprehensive of an increase, and are buying forward. Present quotations for delivery in the South Staffordshire area are :—Best Durham coke, 36s. to 38s.; other grades, 34s. to 35s.; Welsh coke, 31s. to 45s.; Scottish special grades, 38s. 6d. to 40s. per ton.

Steel.

Steady conditions rule in the steel markets, and the recent volume of business has been maintained. Business in semi-finished steel continues active, and this is probably now the busiest branch of the industry. A fair amount of trade is passing to foreign producers, but this does not greatly interfere with the flow of orders to the British works. In some cases the latter are reported to be unable to give delivery until the early part of next year. Conditions in the finished-steel section of the market are irregular, but the general tone is confident, and trade seems to be expanding. The demand from the engineering industries has increased somewhat of late, but the call for shipbuilding steel is poor, and there seems little prospect of an early improvement. Inquiry from overseas markets has become active, but only a comparatively small proportion has resulted in business. Export trading, however, in spite of the difficulties of the exchange and tariffs, appears to be slowly broadening.

Scrap.

Scrap iron is a firm market in the Cleveland area. Foundrymen have been unsuccessful in their efforts to secure heavy metal at 42s. 6d., and merchants are now quoting 45s. per ton. There is a steady demand in the Midlands, the foundries being busy, and prices are firm. Heavy cast iron is still rather slow in the South Wales area, but the demand has picked up in Scotland, where ordinary metal is at 47s. 6d. to 48s., machinery quality, in pieces not exceeding 1 cwt., being at 50s. to 51s. 3d.

Metals.

Copper.—Generally speaking, consumers in Europe are not displaying much confidence in the market at the moment, and are restricting their buying accordingly. Prices have now declined to the lowest level for some months. This decline is attributed to the weakness of the American market. The U.S. domestic price fell last week to about the world level, in spite of the tariff. This was largely due to selling by the Customs plants, who have had difficulty in disposing of their output, and who are unable to reach an agreement with the mining-smelting concerns. The wide margin between standard and electro quotations on the London market is due to the recent heavy selling of standard. Technically speaking, however, the market should now be in a stronger position, and should rapidly respond to any improvement in the trade demand.

The week's prices have been as follow :—

Cash.—Thursday, £32 10s. to £32 11s. 3d.; Friday, £32 13s. 9d. to £32 16s. 3d.; Monday, £32 10s. to £32 11s. 3d.; Tuesday, £32 18s. 9d. to £33 1s. 3d.; Wednesday, £33 8s. 9d. to £33 10s.

Three Months.—Thursday, £32 13s. 9d. to £32 15s.; Friday, £32 17s. 6d. to £32 18s. 9d.; Monday, £32 13s. 9d. to £32 15s.; Tuesday, £33 1s. 3d. to £33 3s. 9d.; Wednesday, £33 11s. 3d. to £33 12s. 6d.

Tin.—Although the South Wales tinplate trade continues to be fairly active, trade demand generally has been slow. Business in this country and on the Continent has fallen off, say Messrs. Rudolf Wolff, whilst very quiet conditions are reported from America. The easier conditions may in a measure be attributed to the political situation which developed over the week-end, but more particularly, perhaps, to the rather less favourable reports from America, where prices have declined on the stock and commodity markets, confidence being rather disturbed by the uncertainties which surround the industrial and financial situation there. Under the circumstances, therefore, it is not surprising that prices should have given way a little, but there is no real weakness, and the market maintains a firm undertone, based on the improvement which has taken place in the statistical position and the further improvement which is expected at the end of the month.

Daily quotations :—

Cash.—Thursday, £221 17s. 6d. to £222 2s. 6d.; Friday, £221 15s. to £221 17s. 6d.; Monday, £222 5s. to £222 7s. 6d.; Tuesday, £222 17s. 6d. to £223; Wednesday, £223 17s. 6d. to £224.

Three Months. — Thursday, £221 15s. to £222; Friday, £221 15s. to £221 17s. 6d.; Monday, £222 2s. 6d. to £222 7s. 6d.; Tuesday, £222 15s. to £222 17s. 6d.; Wednesday, £223 12s. 6d. to £223 15s.

Spelter.—There has been little buying of spelter lately by manufacturers. The galvanised-sheet trade fails to show any improvement, particularly as regards the Indian market. Prices have declined during the past week, in accordance with general conditions on the metal market, but are now showing signs of recovery. The Cartel statistics, which disclosed an increase in stocks last month, as compared with recent regular decreases, are to some extent responsible for the slight loss of confidence in the market.

Price fluctuations :—

Ordinary.—Thursday, £15 17s. 6d.; Friday, £15 16s. 3d.; Monday, £15 11s. 3d.; Tuesday, £15 13s. 9d.; Wednesday, £16.

Lead.—This market has also been influenced by conditions abroad, particularly in the United States of America, where the figures for September show an increase of nearly 6,000 short tons in the stocks and the price—which had been held for some time at the 4.50 cents level—has been reduced, and is now quoted at 4 cents. Although the American situation should not really influence the London market, the price here has fallen to £11 11s. 3d. January; thus most of the recovery which has taken place this year has again been lost. Consumers both in England and on the Continent are, however, doing a fair trade, report Messrs. Brandeis, Goldschmidt, and the fall which has occurred should not deter those who have confidence in the general improvement in business.

Daily market prices :—

Soft Foreign (Prompt).—Thursday, £11 8s. 9d.; Friday, £11 7s. 6d.; Monday, £11 5s.; Tuesday, £11 10s.; Wednesday, £11 18s. 9d.

Capacity of Furnace Electrodes.—In the "Transactions of the Electrochemical Society," B. L. Bailey and R. R. Ridgway describe the determination of the maximum current capacity of furnace electrodes on screw-jointed assemblies of carbon and graphite electrodes. The alternating-current conductivities at various constant-current densities were measured and marked oxidation found of both the carbon and graphite where the surface temperature reached 500 deg. C. The quality of an electrode and its joints may be assessed from the maximum current density which can be carried at this temperature. The point of maximum resistance and steepest temperature rise is at the joint, whose construction thus largely determines the permissible load which can be applied. The marked loss in power generally found at the contacts when using steel electrode clamps, in spite of a good condition assured by polishing, can be notably reduced by employing bronze linings.

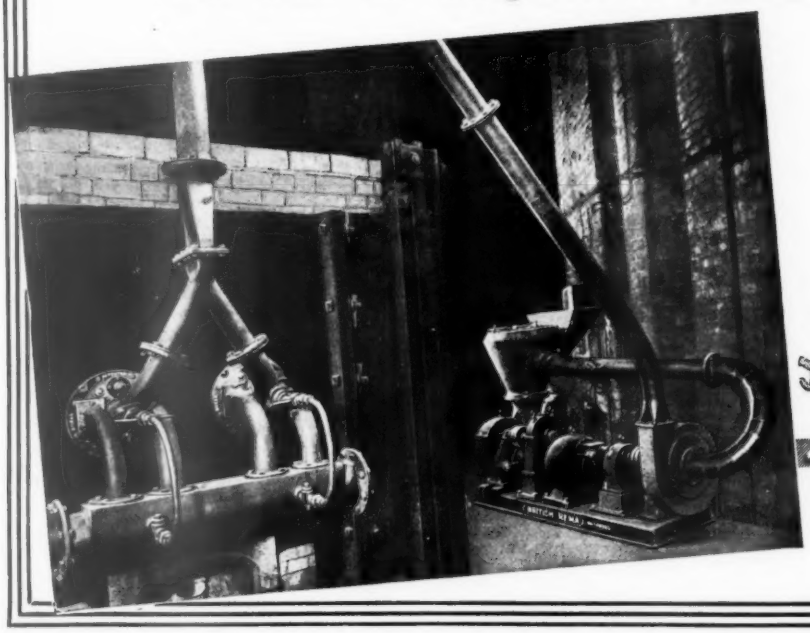
Sterilisation of Goggles.—Goggles which are used by more than one man should always be sterilised before being passed from one person to another. Those returned to store or to the foreman should be sterilised on return, while those usually kept hanging on a hook for general use, *e.g.*, by an emery wheel, might be kept in a bath of suitable disinfectant, such as a solution of formalin, made by placing one part of 40 per cent. formaldehyde solution in nine parts of water.

For goggles which are constantly changing hands, it is preferable to choose a type (all metal and glass) which will stand this method, but if that is impossible, an antiseptic gas such as formaldehyde may be used. The goggles should be kept in the solution or in the gas for ten minutes at room temperature. Other methods are: boiling in water for five minutes, or subjection to live steam at 10 to 15 lbs. pressure for not less than 15 minutes. This last method can be easily applied where the first-aid room has a suitable steriliser.

XUM

Pulverized Fuel Firing for Metallurgical Heating!

The simplicity of the Buell System of P.F. firing is a major factor governing its low power consumption and ease of adaption to existing plant . . .



Every component of the Buell System has been developed to give maximum operating efficiency with reliability in service. Over 28 installations are in operation and each one confirms our two salient claims:

MAXIMUM EFFICIENCY!
RELIABILITY!

You are requested to investigate our System.

The Buell Combustion Co. Ltd.
49, MOORGATE, LONDON, E.C.2

Telephone: Metropolitan 7751 (4 lines).

Illustration shows a Buell Pulverised Fuel Plant firing a Forge Reheating Furnace.

Works: EDGAR ALLEN & Co., Ltd., Imperial Steel Works - - Sheffield.

. . . universally recognised as the leading brand of Cylinder Pig Iron

WARNER CBR

The way to BETTER castings

WARNER & CO. LTD. CARGO FLEET MIDDLESBROUGH

RAW MATERIALS—PRICE LIST.

(Wednesday, October 25, 1933.)

COPPER.

	£	s.	d.
Standard cash	33	8	9
Three months	33	11	3
Electrolytic	36	10	0
Tough	35	0	0
Best selected	35	10	0
Sheets	64	0	0
India	45	0	0
Wire bars	36	10	0
Ingot bars	36	10	0
H.C. wire rods	38	15	0
Off. av. cash, September	35	3	7 3/16
Do., 3 mths., September	35	7	3 7/8
Do., Sttlmnt., September	35	3	8 1/2
Do., Electro, September	38	13	10 1/2
Do., B.S., September	38	3	7 1/2
Do., wire bars, September	39	0	11 1/2
Solid drawn tubes			10½d.
Brazed tubes			10½d.
Wire			7d.

BRASS.

Solid drawn tubes	9d.
Brazed tubes	11d.
Rods, drawn	8¾d.
Rods, extd. or rlld.	5d.
Sheets to 10 w.g.	7⅞d.
Wire	7⅜d.
Rolled metal	7½d.
Yellow metal rods	4¾d.
Do. 4 × 4 Squares	5¾d.
Do. 4 × 3 Sheets	5¾d.

TIN.

	£	s.	d.
Standard cash	223	17	6
Three months	223	12	6
English	224	10	0
Bars	226	0	0
Straits	229	10	0
Australian (nom.)	—		
Eastern	227	15	0
Banca	229	0	0
Off. av. cash, September	216	19	3 3/7
Do., 3 mths., September	216	18	4 1/2
Do., Sttlmt., September	216	19	0 3/7

SPELTER.

	£	s.	d.
Ordinary	16	0	0
Remelted	15	15	0
Hard	13	15	0
Electro 99.9	18	10	0
English	16	15	0
India	16	0	0
Zinc dust	20	0	0
Zinc ashes	3	10	0
Off. aver., September	16	18	6 1/2
Aver. spot, September	16	16	2 1/2

LEAD.

	£	s.	d.
Soft foreign ppt.	11	18	9
Empire	12	2	6
English	13	5	0
Off. average, September	12	1	7 1/2
Average spot, September	11	18	7 1/2

ALUMINIUM.

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	25	10	0
Do., V.M. ex whse.	25	0	0
Rods	29	10	0

ANTIMONY.

	£	s.	d.	£	s.	d.
English	37	10	0 to	40	0	0
Chinese, ex-whse.				26	15	0
Crude				20	10	0

QUICKSILVER.

	£	s.	d.	£	s.	d.
Quicksilver	9	10	0 to	10	0	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£	s.	d.
Ferro-silicon—			
25%	6	10	0
45/50%	12	10	0
75%	18	2	6
Ferro-vanadium—			
35 50%	12	8	lb. Va.
Ferro-molybdenum—			
70/75% carbon-free of Mo.	5/6 per lb.		
Ferro-titanium—			
23/25% carbon-free	9d. lb.		
Ferro-phosphorus, 20/25%	£14	10	0
Ferro-tungsten—			
80/85%	2/4 lb.		
Tungsten metal powder—			
98/99%	2/7 lb.		
Ferro-chrome—			
2/4% car.	25	10	0
4/6% car.	21	17	6
6/8% car.	19	7	6
8/10% car.	18	17	6
Ferro-chrome—			
Max. 2% car.	29	15	0
Max. 1% car.	30	17	6
Max. 0.70% car.	35	15	0
70% carbon-free	9½d. lb.		
Nickel—99.5/100%	£225 to £230		
"F" nickel shot	£202	10	0
Ferro-cobalt, 98/99%	5/6 lb.		
Metallic chromium—			
96/98%	2/8 lb.		
Ferro-manganese (net)—			
76/80% loose	£10 15 0 to £11	5	0
76/80% packed	£11 15 0 to £12	5	0
76/80% export (nom.)	£9	15	0
Metallic manganese—			
94/96% carbon-free	1/2 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten 2s. 0d.
Finished bars, 18% tungsten 2s. 9d.
Per lb. net, d/d buyers' works.

Extras—
Rounds and squares, 3 in. and over 4d. lb.
Rounds and squares, under ½ in. to ¼ in. 3d. lb.
Do., under ¼ in. to 1/16 in. 1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in. 3d. lb.
Do., under ½ in. × ¼ in. 1/- lb.
Bevels of approved sizes and sections 6d. lb.
Bars cut to length, 10% extra.

SCRAP.

South Wales—	£	s.	d.	£	s.	d.
Heavy steel				2	10	0
Bundled steel and shrngs.	1	17	6 to	2	9	0
Mixed iron and steel	2	5	0 to	2	6	6
Heavy cast iron	2	5	0 to	2	6	6
Good machinery	2	7	6 to	2	10	0
Cleveland—						
Heavy steel				2	7	6
Steel turnings				1	11	6
Cast-iron borings				1	2	0
Heavy forge				2	10	0
W.I. piling scrap				2	5	0
Cast-iron scrap	2	5	0 to	2	7	6
Midlands—						
Light cast-iron scrap	1	18	6 to	2	0	0
Heavy wrought iron				2	10	0
Steel turnings, f.o.r.				1	7	6
Scotland—						
Heavy steel				2	7	6
Ordinary cast iron	2	7	6 to	2	8	0
Engineers' turnings				1	15	0
Cast-iron borings				1	15	0
Wrought-iron piling	2	8	0 to	2	10	0
Heavy machinery	2	10	0 to	2	11	3

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	28	0	0
Brass	18	10	0
Lead (less usual draft)	10	10	0
Tea lead	8	0	0
Zinc	11	0	0
New aluminium cuttings	73	0	0
Braziery copper	25	0	0
Gunmetal	24	0	0
Hollow pewter	140	0	0
Shaped black pewter	100	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	65/-
Foundry No. 3	62/6
„ at Falkirk	62/3
„ at Glasgow	65/3
Foundry No. 4	61/6
Forge No. 4	61/6
Hematite No. 1, f.o.t.	63/-
Hematite M/Nos., f.o.t.	62/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	68/6
„ d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	62/-
„ No. 3 fdry.	66/-
Northants forge	58/6
„ fdry. No. 3	62/6
„ fdry. No. 1	65/6
Derbyshire forge	62/-
„ fdry. No. 3	66/-
„ fdry. No. 1	69/-
Scotland—	
Foundry No. 1	67/6
„ No. 3	65/-
Hem. M/Nos. d/d	65/-
Sheffield (d/d district)—	
Derby forge	59/6
„ fdry. No. 3	63/6
Lincs forge	59/6
„ fdry. No. 3	63/6
E.C. hematite	77/-
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	67/-
Staffs fdry. No. 3	67/-
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	80/-
Clyde, No. 3	80/-
Monkland, No. 3	80/-
Summerlee, No. 3	80/-
Eglinton, No. 3	80/-
Gartsherrie, No. 3	80/-
Shotts, No. 3	80/-

FINISHED IRON AND STEEL.

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.)	9	0	0 to	9	15	0
Nut and bolt iron	6	15	0 to	7	10	0
Hoops	10	10	0 to	12	0	0
Marked bars (Staffs) f.o.t.				12	0	0
Gas strip	10	10	0 to	12	0	0
Bolts and nuts, ¾ in. × 4 in.				13	5	0
Steel—						
Plates, ship, etc.	8	15	0 to	8	17	6
Boiler plts.				8	5	0
Chequer plts.				10	7	6
Angles				8	7	6
Tees				9	7	6
Joists				8	15	0
Rounds and squares, 3 in. to 5½ in.				9	7	6
Rounds under 3 in. to ⅜ in. (Untested)		7	0	0	& up.	
Flats—8 in. wide and over				8	12	6
„ under 8 in. and over 5 in.				8	17	6
Rails, heavy	8	5	0 to	8	10	0
Fishplates				12	0	0
Hoops (Staffs)	9	10	0	& up.		
Black sheets, 24g. (4-t. lots)				10	5	0
Galv. cor. shts. („)				12	15	0
Galv. flat shts. („)				13	5	0
Galv. fencing wire, 8g. plain				14	0	0
Billets, soft	5	5	0 to	5	12	6
Billets, hard	6	12	6 to	7	2	6
Sheet bars	5	0	0 to	5	5	0
Tin bars				5	0	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	11d.
Sheet to 10 w.g.	12d.
Wire	12d.
Rods	11d.
Tubes	15½d.
Castings	13d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	18.26
No. 2 foundry, Valley	17.50
No. 2 foundry, Birm.	13.50
Basic	18.89
Bessemer	19.76
Malleable	19.39
Grey forge	19.39
Ferro-mang. 80%, seaboard	82.00
O.-h. rails, h'y, at mill	40.00
Billets	26.00
Sheet bars	26.00
Wire rods	35.00
	Cents.
Iron bars, Phila.	1.74
Steel bars	1.75
Tank plates	1.70
Beams, etc.	1.70
Skelp, grooved steel	1.60
Steel hoops	1.85
Sheets, black, No. 24	2.25
Sheets, galv., No. 24	2.85
Wire nails	2.10
Plain wire	2.10
Barbed wire, galv.	2.60
Tinplates, 100-lb. box	$4.65

COKE (at ovens).

Welsh foundry	20/- to 22/6
„ furnace	14/- to 15/6
Durham foundry	21/- to 25/-
„ furnace	15/-
Midlands, foundry	—
„ furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	16/9 to 17/-
„	28×20 „	33/6 to 34/-
„	20×10 „	24/3 to 24/6
„	18¾×14 „	17/6 to 17/9
C.W.	20×14 „	15/3 to 15/6
„	28×20 „	31/6 to 31/9
„	20×10 „	22/4½ to 22/9
„	18¾×14 „	15/9 to 16/-

SWEDISH CHARCOAL IRON & STEEL.

	£	s.	d.	£	s.	d.
Pig-iron	£6	0	0 to	£7	0	0
Bars-hammered, basis	£16	0	0 to	£16	10	0
Bars and nail-rods, rolled, basis	£15	15	0 to	£16	0	0
Blooms	£10	0	0 to	£12	0	0
Keg steel	£30	0	0 to	£31	0	0
Faggot steel	£18	0	0 to	£23	0	0
Bars and rods dead soft, st'l	£10	0	0 to	£12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.	
Oct.	19 ..	32	10	0	dec. 13/9
„	20 ..	32	13	9	inc. 3/9
„	23 ..	32	10	0	dec. 3/9
„	24 ..	32	18	9	inc. 8/9
„	25 ..	33	8	9	„ 10/–

Electrolytic Copper.

		£	s.	d.	
Oct.	19 ..	36	0	0	dec. 10/–
„	20 ..	36	0	0	No change
„	23 ..	36	0	0	„ „
„	24 ..	36	0	0	„ „
„	25 ..	36	10	0	inc. 10/–

Standard Tin (cash).

		£	s.	d.	
Oct.	19 ..	221	17	6	dec. 42/6
„	20 ..	221	15	0	„ 2/6
„	23 ..	222	5	0	inc. 10/–
„	24 ..	222	17	6	„ 12/6
„	25 ..	223	17	6	„ 20/–

Tin (English ingots).

		£	s.	d.	
Oct.	19 ..	222	10	0	dec. 40/–
„	20 ..	222	5	0	„ 5/–
„	23 ..	222	15	0	inc. 10/–
„	24 ..	223	10	0	„ 15/–
„	25 ..	224	10	0	„ 20/–

Spelter (ordinary).

		£	s.	d.	
Oct.	19 ..	15	17	6	dec. 8/9
„	20 ..	15	16	3	„ 1/3
„	23 ..	15	11	3	„ 5/–
„	24 ..	15	13	9	inc. 2/6
„	25 ..	16	0	0	„ 6/3

Spelter (Electro, 99.9 per cent.).

		£	s.	d.	
Oct.	19 ..	18	10	0	dec. 10/–
„	20 ..	18	5	0	„ 5/–
„	23 ..	18	0	0	„ 5/–
„	24 ..	18	5	0	inc. 5/–
„	25 ..	18	10	0	„ 5/–

Zinc Sheets (English).

		£	s.	d.	
Oct.	19 ..	25	10	0	dec. 5/–
„	20 ..	25	10	0	No change
„	23 ..	25	10	0	„ „
„	24 ..	25	10	0	„ „
„	25 ..	25	10	0	„ „

Lead (English).

		£	s.	d.	
Oct.	19 ..	13	0	0	dec. 5/–
„	20 ..	13	0	0	No change
„	23 ..	12	15	0	dec. 5/–
„	24 ..	13	0	0	inc. 5/–
„	25 ..	13	5	0	„ 5/–

A COMPARISON OF SCRAP PRICES.

Prices of Heavy Steel Scrap (Delivered) in the Principal Districts at the Beginning of Each Month in the Years 1929–1933.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Scotland—													
1929	3 5 6	3 7 6	3 12 6	3 15 0	3 15 0	3 15 0	3 15 6	3 16 0	3 17 6	3 15 0	3 12 6	3 10 6	3 13 1½
1930	3 9 0	3 7 6	3 5 0	3 5 0	3 0 6	2 15 0	2 12 0	2 10 0	2 13 3	2 10 0	2 10 0	2 10 0	2 17 3½
1931	2 7 6	2 7 6	2 5 0	2 5 0	2 0 0	1 17 6	1 17 6	1 17 6	1 17 6	1 15 0	2 0 0	2 2 6	2 1 0½
1932	2 2 6	2 2 6	2 0 0	1 17 6	1 17 6	1 17 6	1 15 0	1 15 0	1 12 6	1 13 0	1 12 6	1 15 0	1 16 9½
1933	1 15 0	1 17 6	1 18 6	1 18 9	1 18 0	1 17 6	1 18 9	2 0 0	2 2 6	2 5 0	—	—	1 19 1½*
North-East Coast—													
1929	3 0 0	3 2 6	3 3 6	3 3 6	3 3 6	3 5 0	3 5 0	3 5 0	3 5 0	3 6 6	3 5 0	3 3 6	3 4 0
1930	3 3 6	3 3 6	3 2 0	3 0 0	2 17 6	2 10 0	2 10 0	2 7 6	2 7 6	2 7 6	2 5 0	2 6 0	2 13 4
1931	2 6 0	2 6 0	2 5 0	2 5 0	2 2 6	2 0 0	1 17 6	1 17 6	1 17 6	1 17 6	1 17 6	2 2 6	2 1 2½
1932	2 0 0	2 0 0	1 15 0	1 15 0	1 15 0	1 15 0	1 15 0	1 15 0	1 15 0	1 12 6	1 15 0	1 17 6	2 15 10
1933	2 0 0	2 0 0	2 5 0	2 0 0	1 15 0	1 17 6	2 2 6	2 2 6	2 3 6	2 5 0	—	—	2 1 1¼*
South Wales—													
1929	3 8 6	3 10 6	3 15 0	4 0 0	4 0 0	3 18 0	3 17 6	3 17 6	3 15 0	3 15 0	3 12 6	3 7 6	3 14 9
1930	3 7 6	3 6 0	3 6 0	3 4 0	3 2 6	2 17 6	2 16 0	2 15 0	2 14 9	2 12 6	2 12 6	2 5 0	2 18 3¼
1931	2 5 0	2 7 6	2 7 6	2 7 6	2 5 0	2 2 6	2 0 0	2 0 0	1 18 0	2 2 6	2 5 0	2 7 6	2 4 0
1932	2 6 6	2 6 0	2 5 0	2 2 6	2 2 0	1 19 0	1 17 6	1 18 6	1 18 0	1 18 0	1 17 6	1 18 0	2 0 8½
1933	2 0 0	2 1 6	2 4 0	2 3 6	2 3 6	2 3 0	2 5 0	2 5 0	2 8 0	2 10 0	—	—	2 4 4*

* Ten months.

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